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Classified Advertisements—Supp. 19.
Index to Advertisers—Page xl.

An Unanswerable Case

Trolley-buses in Towns

EACH year of the last decade has seen a further reduction in the mileage of tramways in service. In many of the smaller towns with low traffic densities, especially where track renewals had become necessary, tramcars quite clearly could not compete with rail-less vehicles, but of late the opinion of transport managers, even in such big areas as London and Manchester, has hardened against their retention, an important objection being that the growth in number and speed of other vehicles has made it increasingly dangerous to take up passengers from and discharge them into the middle of the road, which, moreover, impedes the general traffic.

There are only two practicable successors to the tramways—the trolley-bus and the oil-engined bus. London, to its own great satisfaction, as the article by Mr. J. H. Parker in this issue clearly shows, has chosen the first. The trolley-bus system involves a greater capital expenditure (some of which can be saved by the value of salvage from a superseded tramway system), but capital charges on the two schemes are not anything like in proportion to initial expenditure, since an appreciably longer life can be assumed for loan purposes for the trolley system.

Moreover trolley-buses have a greater carrying capacity; those of the London Passenger Transport Board can seat seventy passengers as against fifty-six for the oil buses, so that the cost of four of the one type should be compared with that of five, at least, of the other. Again the better acceleration of the trolley-bus adds to its earning ability.

Operation Ratios

Difficulties once experienced in the construction and the maintenance of overhead equipment have been overcome. Even in London with its streets congested with cables and pipes, not to mention cellars, it has been possible to find positions for some 20,000 trolley poles, while dewirements have been reduced to less than three in 10,000 vehicle-miles.

The cost of electricity, although only a small proportion of the total operating costs, becomes of importance when traffic conditions are such as to make the working costs of the two kinds of buses about equal. In London the cost of low-voltage power is 0.535d. per kWh, and the last annual report of the London Passenger Transport Board shows the working expenses of its trolley-buses to be 10.65d. per service-mile and the ratio of working costs to gross revenue to be less than 70 per cent. With the oil buses the cost per vehicle-mile works out at 11.20d. and the operation ratio at over 82 per cent. In Manchester, where the decision as to the method to be adopted has yet to be made, the even more favourable rate for power of 0.45d. per kWh has been quoted—less than two-thirds the average figure for the whole country, and there is no apparent reason why a trolley-bus system there should not give correspondingly better results.

Leading the World

Trolley-buses are a distinctively British development in which we have got well ahead of other countries. During the past year or two they or their components have been notable features of the export departments of manufacturers, and engineers and transport managers have been coming here from the Continent and the United States, as well as from the Dominions, to study our practice. The interest taken abroad in trolley-buses will undoubtedly be stimulated by the success achieved in London, but Manchester still carries so much weight in the world that any apparent slackening of its will to maintain its position in the van of progress will have repercussions extending far beyond the loss of 42 million kWh per annum to its own electricity undertaking.

So far we have dealt only with technical and commercial aspects. On wider grounds consideration should be given to the point that approximately 1,000 million kWh is used each year for road transport, requiring roughly 750,000 tons of coal. Apart from the value of this load to a home industry, the possible consequences of dependence on imported fuel cannot be ignored in view of the Ministry of Transport's scheme for oil-fuel rationing in an emergency.

Even if costs and other factors were not so much on the side of the trolley-bus in its appropriate sphere, it remains true that economics is concerned also with public demand. In London, where both types of buses run over the same route, passengers will wait for a trolley-bus. They prefer a type of vehicle which is odourless, noiseless, free from vibration, smooth in acceleration and deceleration, and is in every way comfortable, and which also fulfils the requisite condition of permitting travellers to alight in safety on to the pavement.

An Installation Section?

WE wish more I.E.E. papers were of the type presented by Mr. N. F. T. Saunders last week. Perhaps they will be if Mr. Johnstone Wright's suggestion from the chair that it provided another argument in favour of the formation of an Installation Section foreshadows official action in that direction especially in view of the tendency to raise the status of special sections. We have been expecting something of the kind since Mr. H. T. Young's presidential address two years ago, which itself contained enough ideas to provide a programme for a whole session. To such a Section would belong, for instance, the informal discussion on "Adequate Wiring" opened by Mr. H. G. Taylor on Monday as well as matters relating to small equipment in which installation engineers have or should have a decisive influence. The significance of Mr. Saunders's paper in this connection is that the design of fractional horse-power motors is settled very largely by the conditions under which they are used or the machinery to which they are fitted.

More Plug Points

SEVERAL of those who took part in the I.E.E. informal discussion criticised the estimated costs of wiring new houses given by Mr. H. G. Taylor as being on the low side. If they were, that only swells the total gain to contractors that would come by increasing the size of conductors and the number of plug points sufficiently to provide for a reasonably complete electrical installation. Taking only the 175,000 houses with rateable values up to £26 per annum (or £35 in London) that are being built each year by private enterprise, he showed that the amount to be spent on wiring might be increased by about 90 per cent., bringing in improved business to the extent of £1,400,000. The zest with which an adequate wiring campaign is being prosecuted in the United States and the success which Mr. Taylor showed to be attending it, furnish an excellent example of faith justified by works.

National Service

MUCH as the circumstances which have made it necessary are to be regretted, nobody will doubt the wisdom of the setting-up of the National Service Register and it is to be hoped that the voluntary system will be successful. The importance of the electrical industry is recognised in the list of reserved occupations which includes electrical engineers employed both inside the power stations and on the distribution systems; electricians and wiremen of many classes; electric lamp and valve makers; accumulator and battery makers; electrical instrument makers; and electrical fitters, erectors and fitter-assemblers, apart from a number of other classes connected in one way or another with the industry.

Unexpected Restarting

IT is an attractive idea to fit a thermal overload device in the frame of the motor itself, where the temperature may be very different from that of the control panel. While in some applications automatic restarting after a trip out on overload is an advantage, in many others, such as machine-tool drives, it may cause serious risks, when deliberate switching action by the attendant before a motor can be started should be obligatory. Mr. N. L. Cavallo has done a service in drawing attention to the possibility of mishaps in the absence of such a precaution, since the point is not specifically covered by the Factory Electricity Regulations except, of course, in the over-riding Regulation No. 1, which provides that all apparatus shall be of a kind that prevents danger. While the 1937 Factories Act provides against unwanted mechanical starting in Section 14 (3), no mention is made of electrical possibilities in this connection. This is something, too, for the forthcoming revised edition of the I.E.E. Wiring Regulations, as No. 705, relating to the control of motors, does not meet the requirements of the present case.

Is Cooker Hiring Economic?

THE extraordinary variation in the hiring charges for electric cookers raises the questions of what hiring charge is economic, and, indeed, whether simple hire pays at all. There is no doubt that the low simple hire terms offered by some gas companies for their cookers result in many hundreds of potential electric cooker users adopting gas, and once it is installed there follows the gas fire, copper, water heater and even refrigerator. One electricity undertaking with a large area and a low charge says that it has proved cooker hiring to be uneconomical, the insuperable difficulty being the extraordinarily high proportion of people who expect a cooker to be wired up and supplied at a low rental and yet who disappear shortly afterwards. Legal action does not pay and the subsequent tenant will not always keep the cooker, which has to be taken back and reconditioned. The total cost involved is sometimes considerable and losses have to be borne by the general body of consumers. Such losses may be justified by the increased sales of energy which result. In any case, an undertaking must weigh up the losses likely to be incurred and balance them against the load, not only of cookers, but of fires, wash boilers and water heaters, which would otherwise certainly be lost.

IN THIS ISSUE

Articles:	*Page*
The Stalybridge Undertaking	*115*
Low-voltage Short-circuit Values	*118*
Future of Urban Transport	*119*
B.E.A.M.A.	*121*
Luminous Tube Interior Lighting	*123*
News:	
New Plant at Barrow	*125*
Hydro-electricity in Madras	*132*
Boiler Tests at Manchester	*132*
New Perth (W.A.) Generating Plant	*142*

The N.J.B. Schedule

IN reporting that the membership has risen to over 6,000 the monthly journal of the Electrical Power Engineers' Association states: "It is significant that most of the increase was due to the influx of new members employed on the utilisation side of electricity undertakings." It is on this side that most difficulty seems to be experienced in placing people in the proper grades of the N.J.B. Schedule. The official organ of the Association of Supervising Electrical Engineers has something to say on this point. Referring to such appointments as installation inspectors, consumers' engineers, chemists, installation engineers and assistants, contract engineers, showroom superintendents, etc., the *Electrical Supervisor* says that they are being advertised as graded under the Schedule when actually the gradings are merely chosen because they fit in with the employers' idea of the proper remuneration for the positions. Thus the Schedule is being used for purposes for which it was never designed. There is certainly a strong case for a new Schedule, but what a task confronts reformers!

The I.M.E.A.

AN extraordinary general meeting of the Incorporated Municipal Electrical Association was to be held yesterday to consider proposals for altering the basis of representation of large, medium and small undertakings upon the Council. It was anticipated that some difficulty might arise in coming to a decision. We hope to publish a report of the meeting in our next issue.

Combating a Falling Industrial Load

How the S.H.M. & D. Transport and Electricity Board has succeeded

THE depression of 1929-30 from which the textile industry has never really recovered set many electricity undertakings in the north of England a serious problem with regard to their dwindling loads. Some of them indeed supplied so much of the total energy generated to the textile factories that new outlets for their product were essential if their record of progress was to continue.

Few undertakings were more involved than the Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board, and few can claim more credit for the way the situation has been met. Ten years ago the load taken by cotton manufacturers amounted to 75 per cent. of the total and although the district was one of the last to be affected, the power consumption declined from 37¼ million kWh in 1929-30 to 31 million kWh in 1930-31, the total sales falling in the same period from 43 million kWh to just under 37 million kWh. At least twenty mills were closed and actually about half of them have been pulled down. Moreover, a large number of iron and brass foundries and other works related to the manufacture of cotton goods were thrown out of commission.

This was the depressing state of affairs that Mr. J. Harwood Lumsden had to face when he was appointed chief engineer in 1929. Though a certain degree of recovery was probable, it soon became obvious that it could never again be hoped that the cotton industry would hold such an important position in the activities of the Board. Opportunities for increasing the amount of electrical equipment installed in the mills still remaining would, of course, occur from time to time as the existing plant became obsolete. Full advantage has, in fact, been taken of these and quite a number of the mills are now completely electrified, one of the most important cotton consumers, Ashton Bros. & Co., Ltd., Hyde, Cheshire, now taking a load of about 2,300 kW and consuming 5 million kWh annually in the company's three mills at Carrfield, Throstlebank and Wharfshed. But even so, the cotton load to-day represents only about 35 per cent. of the total—barely half what it was ten years ago.

What, then, has been found to take its place? In the first instance greater attention has been given to the attraction of other classes of power consumer. No possible load, no matter how small, has been neglected and the resulting tendency gradually to substitute electrical for steam-driven machinery, as the latter becomes antiquated, has justified this policy.

During the past two years (to March 31st in each case) the energy sold for power has increased successively from 41¾ million kWh to 46¼ million kWh and 52 million kWh, and since March 31st, 1932 (before that date there was no separate classification) the number of industrial power consumers connected has advanced from 175 to almost 400. Numbered among the larger consumers are now Imperial Chemical Industries (Rexine), Ltd., which since 1929-30 has increased its annual consumption from 1¾ million kWh to 5¼ million kWh; Redfern's rubber works (annual consumption 2 million kWh); the Victor Mill group (3½ million kWh); Fletcher's cigarette paper factory (2½ million kWh); the L.N.E.R. wagon works (¾ million kWh); Wall's ice-cream factory (1½ million kWh), and Newton Mill, Ltd. The last-mentioned company's stationery works, which accounts annually for about ½ million kWh, is practically all-electric. Individual electric drives are employed almost exclusively, while few factories can boast better lighting. Panel heaters are used in the up-to-date welfare centre provided.

Since 1936 the Board has been one of the very few far-sighted authorities which have standardised thermostatic oven control on all cookers. Its merits are here being explained by a showroom assistant *[Elec. Rev. photo.*

Glove and hat making, quarrying and various engineering processes also provide substantial loads and, among the electrical manufacturers who have chosen the district for their factories, are the Tudor Accumulator Co., Ltd., and Measurements, Ltd. A somewhat gruesome industry recently established is the production of bakelite coffins.

The existing charges for power are arranged on a sliding scale starting at 2½d. per kWh for the first 150 kWh per quarter less 5 per cent. discount for prompt payment, but so rapidly does the rate decrease with higher consumption that the average revenue per kWh sold for power is only just over ½d. (0.529d. last year). To encourage off-peak load, a further reduction of 20 per cent. is made for energy consumed between 6 p.m. and 7 a.m. on weekdays, and 1 p.m. Saturdays to 7 a.m. Mondays.

Two views of the Board's extensive domestic appliance repairs department, showing (right) water heaters on test

While such a remarkable recovery has been made in the industrial power load, it is on the domestic side that development has been most concentrated. When, in 1929, Mr. Lumsden decided to "go all out" for the domestic load, there were only just over 3,500 homes which altogether used annually a little more than 3 million kWh, almost entirely for lighting purposes. To-day there are nearly 25,000 consumers and, for the twelve months ended March 31st last, energy sold for domestic

purposes had risen to no less than 15¾ million kWh, the sales being progressively 3 million kWh higher for each of the past two years.

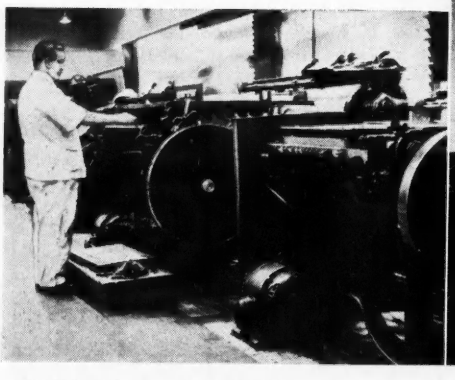
Undoubtedly much of the success of the venture is attributable to Mr. Lumsden's practice of thoroughly trying all apparatus, &c., in his own home before making it available to consumers generally. Every circuit in his house is separately metered, and complete records have been kept of the consumption for each service—lighting, cooking, heating, water heating and power. Incidentally, he finds that he saves 4½d. to 6d. a week by using electricity instead of gas for cooking.

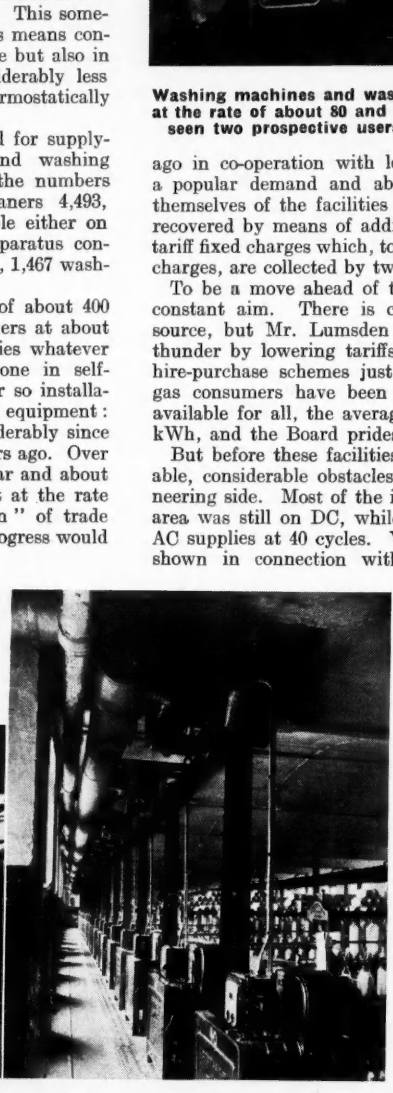
By taking these precautions, many of the pitfalls which beset the engineer attempting to build up a domestic load have been avoided. The mistake has not, for example, been made of sending out cookers for use with unsuitable equipment, and every one having a solid hotplate is supplied complete with flat-bottomed kettle, saucepan and frying-pan. One other result of Mr. Lumsden's investigations has been the appreciation of the merits of thermostatic oven control, and since 1936 the Board has been one of the very few far-sighted authorities which have adopted it as standard on all cookers. This somewhat drastic decision besides benefiting consumers means considerable savings not only in eventual obsolescence but also in maintenance costs. It is found, too, that considerably less time is spent in instructing new users of thermostatically controlled cookers than with ordinary cookers.

Very reasonable hire-purchase terms are offered for supplying cookers, vacuum cleaners, refrigerators and washing machines and, at the end of December, 1938, the numbers installed were as follows:—Cookers 2,257, cleaners 4,493, refrigerators 39 and washers 412. Fires, available either on hire or hire-purchase, numbered 2,328, while apparatus connected on simple hire included 1,923 water heaters, 1,467 washboilers and 1,394 breakfast cookers.

Cookers are now being connected at the rate of about 400 a year and the even more popular breakfast cookers at about 500 a year. Since most premises have no facilities whatever for obtaining hot water, a good business is done in self-contained water heaters and most of the three or so installations carried out each week are for this type of equipment: the rate of connection has been accelerated considerably since the installation charge was discontinued three years ago. Over a thousand vacuum cleaners were supplied last year and about 400 washboilers, washing machines being put out at the rate of 80 or so a year. But for a slight "recession" of trade generally, which set in towards the end of 1937, progress would probably have been substantially greater.

In spite of the depression, cotton mills still account for the greater part of the power load and (right) are a few of the individual electrical drives at Ashton Bros. & Co.'s Carrfield Mills. The stationery works of Newton Mills, Ltd. (below) is practically all-electric

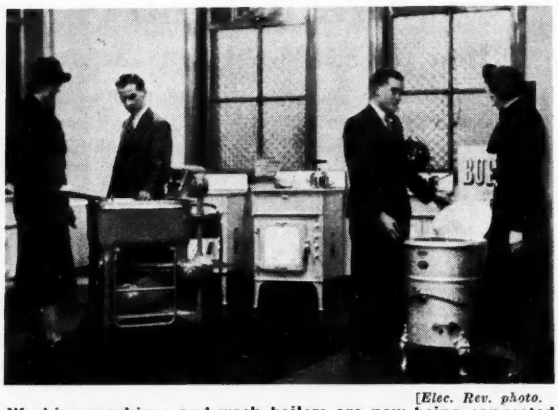




Realising that equitable tariffs are the most important factor in load development, the Board has taken particular care in its domestic all-in tariff to see that, while the poorer classes of consumers are not called upon to pay more than they can reasonably afford, concessions are granted for increased use of electricity. The fixed charge is 15 per cent. per annum on the first £30 of rateable value (minimum rateable value £12) and 5 per cent. on the next £20, no charge being made on rateable value above £50. The "unit" charge is ½d. per kWh for the first 500 kWh per quarter, and also for additional energy at the rate of 20 kWh per quarter for each £1 rateable value above £12 and up to £37, excess energy being supplied at ½d. per kWh. A discount of 1½ per cent. is made for prompt payment of accounts.

In a similar tariff for combined business and domestic premises the "unit" charge is the same but the fixed charge is only 10 per cent. of the rateable value (minimum £20 rateable value). The ordinary lighting flat rate is 4½d. per kWh for the first 500 kWh per quarter, 4d. for the next 1,000 kWh, and 3d. for all excess energy, less a discount of 2½ per cent. A special rate is offered to doctors and dentists.

A new scheme of assisted wiring evolved about three years



[Elec. Rev. photo.

Washing machines and wash boilers are now being connected at the rate of about 80 and 400 a year respectively. Above are seen two prospective users at the Board's new showrooms.

ago in co-operation with local electrical contractors has met a popular demand and about 6,000 consumers have availed themselves of the facilities offered. The cost of the wiring is recovered by means of additional sums added to the domestic tariff fixed charges which, together with the normal ½d. "unit" charges, are collected by two-part tariff prepayment meters.

To be a move ahead of the gas undertaking is the Board's constant aim. There is considerable competition from this source, but Mr. Lumsden has so far contrived to steal its thunder by lowering tariffs or introducing assisted wiring or hire-purchase schemes just at the time when concessions to gas consumers have been made. Cheap electricity is now available for all, the average price last year being 0.789d. per kWh, and the Board prides itself on its continuity of supply.

But before these facilities could be made so generally available, considerable obstacles had to be overcome on the engineering side. Most of the inner portion of the Board's supply area was still on DC, while the outer districts received their AC supplies at 40 cycles. With the same typical ruthlessness shown in connection with the thermostatically controlled ovens, the two 8,500-kW twin-cylinder turbo-alternators installed when the Hartshead generating station was built in 1925 were scrapped and replaced in 1931 by three 12,500-kW, 3-phase, 50 cycle, 6,600-V turbo-alternators. In addition, the steam pressure of the existing four water-tube boilers (35,000 lb. per hr. evaporative capacity each) was increased from 275 to 300 lb. per sq. in. and the temperature from 600 to 700 deg. F., four further boilers (50,000 lb. per hr. evaporative capacity) being installed.

Incidentally, the recent growth of load has necessitated further extensions to this plant and the installation just completed of a 31,250-kW turbo-generator working at 830 deg. F. and a pressure of 600 lb. per sq. in. brings the total capacity of the station up to 68,750 kW. Three new boilers, each of 150,000 lb. per hr. evaporative capacity, have also been installed, together with necessary auxiliaries. Additional switchgear was, of course, necessary and the opportunity has been taken to sectionalise the whole of the old and new equipment with a view to avoiding extensive damage from fire or electrical breakdown. The whole of the structural steelwork is encased in fire-resisting material. A prominent feature of these latest extensions is a new chimney 330 ft. high and 17 ft. 6 in. internal diameter at the top which is said to be the highest chimney in Cheshire.

The change of frequency from 40 to 50 cycles necessitated the replacement of all the motors in the Board's area. This was done without any interruption in the working hours of consumers and, to enable the scheme to be carried out expeditiously, it was previously necessary to lay a further network of cables so that, where needed, it was possible to supply at

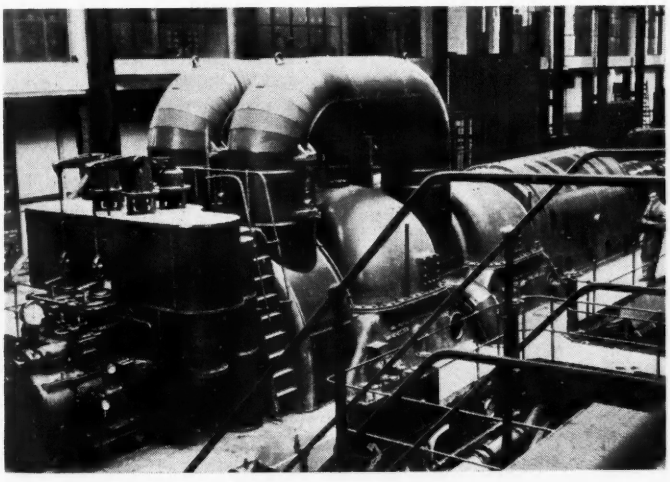
either frequency. This method was preferred to using frequency changers, since it resulted in the undertaking's obtaining additional mains for further development at a very economical price. Due to these change-overs, consumers were afforded an opportunity to improve their electrical drives and bring their plant installation up to date.

Actually, since the policy of domestic electrification was inaugurated, the length of extra-high-voltage cable has been increased by about 50 per cent. and low-voltage cable by about 300 per cent., the Board now possessing nearly 400 miles of mains, of which approximately one-fifth is overhead. In addition, an extensive feeder protection system has been installed. The most recent mains developments include the erection of an overhead 6,000-V line 4½ miles long from Greenfield to Bleak Hey Nook, Diggle, and a similar line from Broadbottom to Hattersley for the purpose of supplying farms which are fairly numerous in this district. Throughout the Board's area there are now about 150 farms connected, each one using about 2,000 kWh a year.

Laying underground mains to supply Bank Field Mill, Doboross, and erecting a portion of the new 4½-mile stretch of 6,000-V line from Greenfield to Bleak Hey Nook, Diggle *[Elec. Rev. photos.*

With the completion of the change of frequency, the old Tame Valley station, which had been in commission since the Board started operations in 1903, finally ceased generating in November, 1932, since when it has been used as offices and a central depôt. By 1936 the growth in the number of consumers had necessitated such a large increase in staff that the office accommodation was becoming exceedingly overcrowded. Assisted financially by the proceeds of the sale of the old generating plant, the Board therefore decided to proceed with a scheme for the modification of the building.

The premises were officially reopened in October last and, besides providing offices of modern design, include an all-electric canteen, well-lighted workshops, stores, a domestic appliance repairs department and a meter-testing station. The repairs shop and meter-testing station are among the largest



we have seen and the facilities in the latter, which is equipped with the most up-to-date apparatus available, have been offered to and accepted by several neighbouring authorities.

In 1934 a records department was formed with the purpose of preparing and keeping records of all consumers' accounts, and a new system of ledger posting was inaugurated, together with a unique costing system.

The provision of the new offices has enabled the old premises adjacent to be utilised for showrooms in place of the inadequate building which had previously been a small storeroom. Apart from various sections devoted to general displays, the new showrooms contain a model bathroom and a large hall, which is at present divided into two sections, one for demonstrating domestic appliances and the other for industrial equipment.

Besides the demonstrations given here, others are held weekly at the Hyde showrooms. Both Mossley and Dukinfield also have showrooms but no provision is made there for large-scale demonstrations. In the rural areas considerable use is made of the travelling showroom and further display facilities are provided by a window at the Mottram sub-station and by display cabinets at the general offices in Waterloo Road, Stalybridge. Accounts are collected at all the showrooms. Exhibitions are found to bring a considerable amount of business.

Four outdoor representatives or canvassers and two women demonstrators follow up inquiries received and visit new consumers either to persuade them to use additional appliances or to demonstrate how they are used. No trouble is too great to secure a satisfied consumer. The showrooms are opened specially for consumers who are unable to visit them during ordinary hours and different types of apparatus will be taken to the consumers' own homes for them to choose from before signing up. "Pushing" of apparatus at all costs is, however, discouraged, for it is felt that one "bad" consumer can do more harm than many good ones.

The electricity undertaking's close connection with the Transport Department has resulted in some novel applications of electricity in connection with the buses. All the clocks used for time-keeping are electric and special illuminated "Stop" signals have been designed by Mr. A. G. Grundy, the Board's transport manager, and made by the Equipment and Engineering Co., Ltd., for the use of persons waiting at the bus stops (see illustration on page 142). Street lighting is of various types, approximately 1,700 lamps being used to illuminate 50 miles of streets. A recent sodium installation of which the Board is justly proud was carried out for the Longdendale U.D.C. Stalybridge is one of the few towns where the pedestrian crossings are illuminated.

At the moment the Board supplies an area of approximately 58 sq. miles, which includes nineteen towns and villages and has a population of about 114,000. At December 31st last the total number of consumers (28,199) represented 503 per sq. mile and the total load connected was 94,400 kW, composed of 39,365 kW domestic, 54,188 kW industrial power, 347 kW public lighting and 500 kW tramways. The greatest load yet recorded occurred on December 22nd, 1938, when the figure was 26,600 kW. For the year ended March 31st last, the total sales amounted to 69 million kWh, about 9 million kWh more than in 1936-37, 16½ million kWh more than the year before and 33 million kWh more than in 1930-31. Negotiations are now proceeding to place a Bill before Parliament authorising the Board to purchase the Glossop undertaking which is owned by the Urban Electric Supply Co., Ltd., and also other adjacent undertakings if this should ever be considered desirable.

To meet the recent growth of load this new 31,250-kW Metrovick generator has just been installed at the Hartshead generating station *[Elec. Rev. photo.*

In conclusion, we should like to thank Mr. Lumsden for his help in the preparation of this article and also his assistants, particularly Messrs. H. Linney, secretary; J. Ford, chief clerk; C. Rathbone, generating engineer; H. J. Spring, mains superintendent; F. Mather, sub-station superintendent; J. R. Marsh, meter superintendent; and H. Smith, showroom manager.

Low-voltage Short-circuit Values

The effect of impedance of connections

By R. T. Lythall, Assoc.I.E.E.

Mr. Lythall is assistant manager of the switchgear and transformer department of Johnson & Phillips, Ltd.

IN any calculation to determine the fault MVA to be anticipated at the bus-bars of a low-voltage system it is important to take into account all factors tending to reduce the fault value. The reasons for this have been repeatedly stressed recently in the ELECTRICAL REVIEW* and elsewhere.

Not least among these factors is the reactance (and often the resistance) of the conductors between the plant and the switchgear. In those networks where cable is used, little difficulty is experienced in obtaining ohmic value for reactance, resistance and impedance from published data of cable manufacturers. Where the connections are made in bare copper in the nature of bus-bars, little information of a ready nature is, however, available, and it is necessary to undertake calculations based on self and mutual inductance which may often be laborious. One method of making such a calculation is given in the author's recently published book†, by which sufficiently accurate values may be obtained for practical purposes.

As a separate calculation becomes necessary to each variation of conductor section, phase spacing, &c., the need for a representative table of values is often felt. It is to this end that the accompanying table has been prepared. In present-

No. of straps and section.	Phase centres In.	Reactance factor Kx.	Resistance factor Kr.
1, 2in.×¼in.	3	3.871	1.67
	4	4.421	
	5	4.85	
	6	5.24	
2, 2in.×¼in.	3	3.488	0.83
	4	4.038	
	5	4.465	
	6	4.812	
	7	5.107	
	8	5.366	
3, 2in.×¼in.	4	3.717	0.55
	5	4.144	
	6	4.493	
	7	4.79	
	8	5.043	
	9	5.27	
1, 3in.×¼in.	3	3.17	1.1
	4	3.717	
	5	4.144	
	6	4.493	
2, 3in.×¼in.	3	2.895	0.55
	4	3.45	
	5	3.871	
	6	4.22	
	7	4.515	
	8	4.77	
3, 3in.×¼in.	4	3.21	0.37
	5	3.631	
	6	3.981	
	7	4.275	
	8	4.53	
	9	4.755	
4, 3in.×¼in.	5	3.386	0.275
	6	3.768	
	7	4.062	
	8	4.317	
	9	4.542	
	10	4.744	
1, 4in.×¼in.	3	2.75	0.83
	4	3.21	
	5	3.631	
	6	3.981	
	7	4.275	
	8	4.53	
	9	4.755	
2, 4in.×¼in.	3	2.59	0.42
	4	2.993	
	5	3.386	
	6	3.768	
	7	4.062	
	8	4.317	
	9	4.542	
3, 4in.×¼in.	5	3.29	0.275
	6	3.577	
	7	3.871	
	8	4.13	
	9	4.351	
	10	4.553	
	11	4.735	
	12	4.901	
4, 4in.×¼in.	6	3.403	0.21
	7	3.70	
	8	3.952	
	9	4.18	
	10	4.378	
	12	4.728	
	15	5.153	
6, 4in.×¼in.	9	3.871	0.138
	10	4.072	
	12	4.421	
	15	4.844	
	18	5.196	
2, 6in.×¼in.	4	2.322	0.275
	5	2.75	
	6	3.10	
	7	3.39	
	8	3.65	
	9	3.871	
	10	4.072	
4, 6in.×¼in.	6	2.833	0.138
	7	3.13	
	8	3.382	
	9	3.61	
	10	3.81	
	12	4.157	
	15	4.58	
	18	4.931	
6, 6in.×¼in.	10	3.577	0.092
	11	3.758	
	12	3.93	
	15	4.351	
	18	4.70	
	21	5.00	
	24	5.257	

Phases in horizontal plane. Multiple bars spaced ¼ in. All figures based on a frequency of 50 cycles per second.

ing it, however, the earlier reference to "sufficiently accurate values for practical purposes" should be borne in mind. This is important, in that in making calculations for the preparation of the table the following simplifications have been allowed:—(*a*) In the case where a phase conductor consists of multiple straps (*e.g.*, three 4 in. × ¼ in.) it is assumed that these are consolidated to form a single conductor equal to the dimensions of the multiple arrangement (*e.g.*, 4 in.×1¼ in. in the case of three 4 in. by ¼ in. with ¼ in. spacing between straps). (*b*) It is assumed that current distribution is uniform over the cross section. (*c*) Values are based on the *average* per phase. These assumptions reduce the amount of arithmetic involved and any error due to them is on the right side in the selection of circuit-breakers of suitable breaking capacity.

In B.S.S. 116-1937 the following formula is given to convert ohmic values to percentage values for use in short-circuit calculation by the percentage reactance method:

Percentage reactance (or resistance) at given kVA base for ohmic value X (or R)=100,000 ×kVA base×ohms/$(V)^2$.

Ohmic values of reactance and resistance for bare conductors involve awkward figures such as 0.0000321 ohm per ft. The accompanying table gives more reasonable values, which have been arrived at by multiplying ohmic figures by 100,000 in the foregoing and thus arriving at what is termed a reactance (or resistance) factor which can be used directly in a modified expression which may be written as:

Percentage reactance (or resistance) at given kVA base= kVA base × Kx (or Kr) × $L/(V)^2$, where Kx=reactance factor from table, Kr=resistance factor from table, L=length of conductor run in ft., V=line voltage.

Where resistance is of importance in relation to reactance as in closely spaced conductors, or conductors of small sectional area, impedance should be used in calculations, using a factor Kz, obtained by $Kz=\sqrt{Kx^2+Kr^2}$.

As an example of use of the table the following may be assumed:—Transformer, 1,500 kVA; line volts, 400; conductors, three 4×¼ in. per phase; phase centres, 5 in.; length, 75 ft. Then percentage reactance of conductors on 1,500 kVA base=1,500×3.29×75/$(400)^2$=2.31 per cent. This, added to the reactance of the transformer (say, 5.6 per cent.), will be of importance in reducing the fault MVA at the l.v. bus-bars.

In a run of conductors where, due to layout or other cause, a variation occurs in the phase spacing, separate calculation is necessary for each spacing, adding the results to obtain the total. In certain cases, calculation of short-circuit values is made, using ohmic values instead of percentage. By multiplying any factor Kx or Kr in the table by 10^5 values are obtained of ohms per ft. Where odd centres such as 5¼ in. or 7½ in. are found, calculations should be made, using the nearest spacing *less* than the actual, *i.e.*, 5 in. or 7 in. in the cases mentioned. Results will thus be on the safe side.

* "Low-voltage Switchgear" and "Low-voltage Short-circuit Calculations," R. T. Lythall, January 14th, and November 18th, 1938.

† "The J. & P. Switchgear Book."

Reduced Output in the United States

OWING to industrial weakness during the early part of the year (there was a substantial improvement later) the total output of electricity in the United States in 1938 was 5 per cent. less than during the previous year, being 114,000 million kWh as compared with 120,000 million kWh for 1937, according to the Edison Electric Institute. Production by water power was 41,500 million kWh, a record figure, but production by fuel-burning plants fell from 74,000 million kWh in 1937 to 67,500 million kWh last year.

Excluding Federal plants, the generating capacity of the electric light and power industry increased by a million kW in 1938, bringing the total at the end of the year to 36 million kW. Total construction expenditure for 1938 (exclusive of Federal work) is estimated at $470 million, barely half the expenditure of the peak year 1930.

There were 27,765,000 consumers taking an electricity supply at the end of last year, representing an increase of 600,000. Of those newly connected 168,000 were farms, making the total number supplied 1,410,000. In addition there were 22 million non-farm homes and 4,250,000 business and industrial establishments using electricity.

Sales of electricity to all consumers amounted to 93,400 million kWh, compared with 99,400 million in 1937, a decrease of 6 per cent. Farm consumption increased 5½ per cent. Residential use increased by 10.7 per cent., the total for the year amounting to 18,580 million kWh. Industrial power suffered the sharpest decline on record, *viz.*, 17.7 per cent., to 44,060 million kWh. In the retail commercial service, however, there was a gain of 5.4 per cent. Total revenue from sales of electricity aggregated $2,173 million, a decline of $8 million. Operating expenses, however, continued to grow.

The average annual use per residential consumer in 1938 rose to 850 kWh from 793 kWh in 1937, the average revenue per kWh falling from 4.39 cents to 4.20 cents. The average farm use in areas where little or no irrigation is involved rose from 1,014 kWh to 1,045 kWh, and the average revenue fell to 4.5 cents per kWh from 4.72 cents in 1937.

Future of Urban Transport

If trams must go, what then?

By J. H. Parker, M.I.E.E.

IN recent months a great deal of conflicting data has been issued regarding the relative merits of trolley-buses and other forms of road transport. These discrepancies are due to comparing data from conditions which are not similar and the conclusions are therefore unreliable.

London Transport, which is the largest user of all kinds of road transport vehicles, issues a very comprehensive report each year containing much useful data but to make a clear comparison certain further factors must be taken into account. For example, if the figures showing the total revenue, the total operating costs and the total car miles run by the various classes of vehicles during the year ended June 30th, 1938, were divided by the total number of vehicles in commission on that date, we should obtain misleading results.

Mr. J. H. Parker is electrical engineer (distribution) to the London Passenger Transport Board

The variation in the number of buses and coaches operating at June 30th, 1937, and June 30th, 1938, showed a change of only 68 on a total of 6,454 vehicles, but the 594 trolley-buses in operation at June 30th, 1937, were increased to 1,026 by June 30th, 1938. Obviously the total costs, revenue and car miles for trolley-buses for the year should not be divided by the 1,026 vehicles in commission at the end of the year; more accurate figures would be obtained by using the mean number in operation during that year, *i.e.*, 810. Neglect of such factors in data supplied by any undertaking where one type of vehicle is rapidly increasing in use can render the deductions not only valueless but very misleading.

Another important factor which is often neglected in making comparisons between buses and trolley-buses is the different nature of the services given by the buses themselves. For example, the coaches and buses of London Transport are divided into three groups. The central buses, painted red, operate generally over an average radius of 10 to 12 miles and cover crowded streets. In such built-up areas there is a maximum of stopping places and the average speed is of the order of 10¾ miles per hour. The country buses of London Transport, painted green, operate only on the outer areas and none of them come into London but only slightly overlap the fringes of the area covered by the red central buses. These vehicles traverse more open roads and have fewer stops, especially in the country between the various towns served; they therefore maintain an average speed of the order of 13¼ miles per hour. The Green Line coaches are express vehicles through London connecting distant points. They have minimum fares to discourage any use except that of long-distance express service and they operate at average speeds of the order of 17½ m.p.h.

Trolley-buses are generally used for town work where their quick acceleration and deceleration make them the ideal vehicle for services with frequent stops. Their average speeds should be compared only with buses operating over similar ground. In London that would be with the central buses; in such a comparison trolley-buses do not show any disadvantage. Unfortunately, in controversies the comparisons are very often made with the average speed of bus fleets where a proportion of the vehicles are on inter-urban traffic, with less stops and working on open roads. In London Transport's annual report the buses and coaches are treated as one unit in comparing operating cost and revenue with trams and trolley-buses, but there is also published the separate car miles run by different types of vehicle and these are given for the year ended June 30th, 1938, as follows:—

Central buses	229.3	million car miles
Country buses	28.2	,, ,, ,,
Coaches	28.3	,, ,, ,,
Trams	74.3	,, ,, ,,
Trolley-buses	35.4	,, ,, ,,

Taking all these factors into account in a straight comparison with buses, the trolley-bus shows no disadvantage.

Capacity

The rivalry between buses and trolley-buses usually arises when the abandonment of tramways is being considered; here the size of the vehicle to be displaced and the increasing congestion of the streets should be considered. London Transport trolley-buses are 70-seaters with the exception of a few of the earlier ones which are 60-seaters. There is no difficulty in making a good layout for 70 seats because, unlike the oil bus, practically all the plant and equipment is below the floor.

Tramcars can be replaced by trolley-buses of this type on the basis of one trolley-bus for each tramcar, but with 56-seater oil buses, such as are used in London, it needs five buses to equal the capacity of four trolley-buses. Even if the trolley-bus were not the better vehicle for town traffic it would pay to use it for tramway conversion in busy streets owing to its better seating capacity.

Operating Costs

The capital cost of trolley-buses is approximately 12 per cent. higher than the smaller seating oil buses. The main difference in price lies in the more expensive electrical equipment as compared with the cheaper engine unit, but the electrical unit has a much longer life than the engine and gear box so that a trolley-bus lasts longer, and the higher initial cost does not adversely affect the trolley-bus as regards annual charges.

The fuel cost should be in the neighbourhood of 1d. to 1¼d. per car mile for each type of vehicle. Some undertakings pay more than others for current, but even a higher price than ½d. per kWh does not add anything appreciable to a cost which is only 10 per cent. of the total working costs. The cost per car mile for oil fuel is also a variable figure depending on the nature of the service, for obviously a frequently stopping town service will not give such a high mileage per gallon as an inter-urban service. From some of the figures given for fuel costs it is obvious that the consumption was not calculated on the type of routes which should be taken when a comparison is made with trolley-bus town routes.

The labour required to operate the trolley-bus and the oil bus is obviously the same for they carry the same crew, and this item represents the larger half of the total costs. On the bulk of items of cost, therefore, there is no advantage for either type of vehicle.

Repairs and Maintenance

When we come to repairs and maintenance, however, it is obvious that a high-compression reciprocating engine vehicle running approximately 1,000 miles a week will need much more costly maintenance than a variable speed electric motor running in grease on ball bearings with no gear box and no wearing parts except carbon brushes on commutators. The trolley-bus scores heavily on this item, and against it can be set only the maintenance of the overhead system, which comes to a fraction of a penny per car mile. Such maintenance as is required by the trolley-bus can be given at night, and there is not the lost time and lost mileage required for overhaul of engines, gear boxes and bearings.

Even assuming that there is no difference in the maintenance cost of the trolley-bus and its overhead system with that of the oil bus, so that we assume that all operating costs per vehicle of both types are the same, the trolley-bus with its greater seating capacity has a higher earning power than its engine rivals. Looked at another way, the working costs of trolley-buses based on seating capacty are lower than the oil bus even if the costs per vehicle are the same.

That the advantage of trolley-buses for road transport is being increasingly recognised is shown by the latest Ministry of Transport returns, where it states that during the year 1937-38 trolley-buses carried 865 million passengers, as compared with 632 million the previous year. Local authorities operate 352 route miles, London Transport 198 route miles, and others 94 route miles.

Reliability

During the recent cold spell large numbers of conduit trams were temporarily put out of commission by a combination of salt and snow, frozen points and other abnormal causes, but, surprisingly, the trolley-buses survived the ordeal and even continued to tackle the Crystal Palace hill when other vehicles hesitated to face it. Undoubtedly the smooth turning effort on the wheels was a great advantage in adverse road conditions.

The regenerative effect of the motors can be used very effectively on hilly routes. On the Crystal Palace route, for example, with a long gradient which rises to 1 in 10, the controls are set to go downhill with the power off and the speed is limited automatically to a maximum of 10 m.p.h. In climbing the hill the regenerative effect is arranged to limit the run back to a speed of 3 m.p.h., should power be lost and

all brakes fail, a most unlikely combination. For security in hilly routes no other vehicle can compare with such control. Added to that is the freedom from vibration, from exhaust fumes, and from dependence on imported fuel.

Overhead Equipment

A free vehicle, as against a fixed-path vehicle like a tramcar, rendered most of the special fittings designed for tramways unsuitable.

London Transport, with the most difficult traffic conditions of any town in the country, was bound to find the weak spots in all the various types of fittings which had been in previous use. After these had been redesigned, the rolling stock and overhead departments allocated a tower wagon with two practical observers to find out why dewirements still took place. Latterly, with several hundred vehicles passing each day, the dewirements at our worst spots seldom exceed one per day, but if they persistently took place at any spot, even though it were infrequent, the observers were put on the job, and after a day or two's observation they were able to make improvements; sometimes it was a slight modification of fitting or trolley head, at other times it was the position of the wire or the driver's lack of experience. Patiently all these were investigated and eliminated, and to-day the average dewirements per 10,000 miles stands round about three in spite of adverse traffic conditions. Put another way, each trolley-bus has a dewirement only once in three weeks, and when we consider the difficulties of traffic and the steady influx of newly trained drivers as routes are converted, it is evident that the overhead equipment has justified the time and trouble spent on design.

One result of the steady improvement of the overhead system was that the drivers became carefree and cheerfully took special fittings, bridges, &c., at a speed that would have been better reduced, but this only led to still further improvements in design. To-day there can be no doubt that the trolley-bus and overhead system are reliable and equal in performance to that of any type of road vehicle. London Transport places freely at the disposal of all interested the experience of its staff, and any undertaking can start at the point which it has reached. This is recognised by many managers, who specify the exact fittings which London Transport has found best for any particular purpose.

Electric Frogs

Electrically operated frogs actuated by a push-button at the bus stop represented a great improvement in operation. Bus stops are always sited a little way back from a road junction. Putting the frog immediately in front of the vehicle stop position ensures that the vehicle takes the frog just before it has gained speed; also the vehicle moves into its correct traffic stream before reaching the junction, and, if it turns to the left, goes round the corner travelling on a smooth wire free from fittings. The frog is actuated by a push-button on the stop pole, and directly the bus moves forward the push-button and frog are free for the next vehicle.

In addition to operating the frog, the push-button lights a lamp indicator on the next pole to show how the frog is set. In case of failure, the electric frog can be hand-operated. The frog fitting has been modified so that the change of direction is spread over the whole fitting and not at the tongue itself, which enables the frog to be taken at high speed; separate tongues are provided for the two positions, the tongue being locked in the right line; the locking device includes a drum to enable the pull to operate over a wide angle.

Under bridges spring hangers give silent passage, but in many cases where there is very limited headroom the trolley wire has been clipped on to a steel tee bar mounted on porcelain insulators. Sudden changes in height, such as from a low bridge to normal height, should be avoided, as oscillation is set up due to the weight of the head at the end of the long boom when held flat out. Efforts have been made to mitigate this tendency to oscillation on the boom when the bus is running far out of its normal course by stiffening the boom, but this only increased the weight and intensified the trouble. The use of standard shock absorbers on the boom has shown most promising results and is being tried on a large scale.

To prevent booms that may be dewired swinging round violently and doing damage, the tail of the boom is arranged to contact with "Ferodo" brake pads to stop the swing when the boom rises above normal height. In special fittings, where heads are likely to be trapped on dewirement, baffles are fitted to prevent the head catching.

Shoe collectors are essential for large-capacity trolley-buses, where the heavier starting current requires a greater contact between wire and collector than is possible with a wheel. Shoes with carbon inserts have been greatly improved, and will give an average life of over 1,000 miles before the carbon inserts, which cost 4½d. each, need renewal. It took over a year of experiment before the correct grade of carbon and its treatment for wet weather was perfected. It is not desirable to run both wheels and carbon shoes; the wheels make a rough surface which is worse than a file on the carbon blocks.

On new wire, or wire where wheels have been in operation, a steel shoe must be used for a few journeys to smooth the wire. Afterwards, it must be lubricated by a graphite compound at frequent intervals till a skin has been formed. Less frequent lubrication after that will maintain a commutator finish between carbon and copper wire which is quite silent in operation.

Unearthed Overhead Systems

For tramway work, the negative side of the system being laid in the street is at earth potential, and so the negative side is always earthed. When trolley-buses were introduced, the negative was still maintained at earth potential, although the positive and negative were both in the air and insulated. The Ministry of Transport regulations for trolley-buses, being based on tramway practice, provided for an earthed negative system, with the guard wire connected on to the earthed negative at every fifth span.

Three years ago the Ministry agreed to modify these regulations so that London Transport could run its trolley-bus system all-insulated, and the experiment has come up to expectation and revealed no defects. An all-insulated system can be turned into an earthed system by merely closing a switch to connect one side of the system to an earth plate; therefore, in an all-insulated system, if either overhead wire breaks and falls to the ground it is equivalent to earthing the fallen wire, and so long as the fallen wire is in contact with the street, it is at the same potential as the ground on which it rests, while the other wire left in the air immediately assumes a potential of 600 V above or below that earth potential. The advantage of this is obvious.

It is advisable to come to terms with the Post Office and other overhead-wire users to insulate their wires whenever they cross trolley-bus wires; that is the invariable practice in London, and eliminates a great deal of possible trouble and avoids the problem of earthing guard wire in an insulated system.

Sub-stations and Feeders

Generally, it does not pay to space sub-stations more than two miles apart. At that distance the longest pair of feeders from each sub-station is only half a mile, while to feed a further half-mile section a pair of cables one mile long has to be run. The sub-stations are cheap to install and, being unattended, are cheap to operate.

The feeders to the track are controlled by contactors on the negative side, and are protected on the positive side by high-speed circuit-breakers, capable of automatically reclosing a number of times over a predetermined period of 3 minutes 20 seconds before finally locking out.

The circuit-breakers protecting the rectifiers are arranged to come out only for reverse current and not for forward current. As each feeder is protected for overload there is no need to protect the rectifiers against overload. We do not want the whole sub-station shut down for a surge on one feeder section. As an added precaution the reclosing intervals for all the feeder circuit-breakers are graded, so that they operate in sequence and so limit the total demand for starting current on the sub-station after a shut-down.

At the track end of each pair of feeders two push-buttons are installed in the feeder pillar. The "open" button, when depressed, can be held down with a catch. In this way the traffic or electrical staff can cut off the current and keep it off in the event of trouble without leaving the half-mile route. When the trouble is cleared the circuit is reset by releasing the catch and depressing the "close" button. Similarly, if a circuit-breaker has locked out there is no need to go to the sub-station to reset it; the depressing of the "close" button is sufficient to restart the breaker on its reclose cycles again.

I trust that these notes upon outstanding features of trolley-bus operation will enable those who have to make the decision to obtain a clearer view of the matter and to give the trolley-bus the consideration to which it is entitled on its merits.

Whilst tramways may be the most economical means of moving big crowds, modern traffic conditions demand that they be replaced.

Trolley-buses in Belfast

IT has been decided not to renew the tramway track on the east side of Belfast, where it is due for relaying, but to substitute for the present tramcars, trolley-buses, a number of which are already plying on the west side of the city and giving much satisfaction. The change-over will cost in the neighbourhood of £1,250,000 for the entire city and of that sum the immediate change-over in the east end will cost approximately £500,000. About 300 buses will be used, and they will be supplemented by petrol buses.

Organisations of the Industry—V

British Electrical and Allied Manufacturers' Association

By V. Watlington, M.I.E.E., Director

THE necessity for some central advisory or administrative body to co-ordinate the activities of an industry and to express the views of its members as a whole is so generally recognised at the present time that it is difficult to realise the opposition to such a proposal that existed thirty years ago. In 1911, the year of the incorporation of the B.E.A.M.A., the electrical manufacturing industry of Great Britain, weakened by a long period of internal strife, was steadily losing ground in the face of intense foreign competition. Manufacturing firms were operating as disconnected units, each following an individualistic policy which was rapidly bringing them to a state of helplessness.

The task of the newly formed Association was, therefore, to convince electrical manufacturers that the best interests of the industry would be served by organisation and co-operation. This article indicates how that object has been attained.

The many-sided activities of B.E.A.M.A. make it one of the most influential bodies in the electrical industry. This brief survey of the Association's work by its Director indicates how much has been done in its twenty-eight years of existence.

Origin and Growth

The history of B.E.A.M.A. is matter for a volume, but a few lines must suffice to summarise it here. The nucleus of the organisation had existed prior to 1911 in the National Electrical Manufacturers' Association whose affairs it took over. Beginning by contact with the Government and kindred organisations, such as the Institution of Electrical Engineers, the Incorporated Municipal Electrical Association, and others, B.E.A.M.A. at once tackled the difficult and pressing problems of conditions of contract for electrical work, of railway and shipping charges and of standardisation. Neither local nor exclusively national, but taking within its view the whole British Empire, it became linked in friendly consultation with electrical organisations in other countries and set up local committees in Australia, South Africa and India.

By 1919 B.E.A.M.A., then of only eight years' standing, and with the war deflecting its activities during five of those years, was in active joint work with all the institutions and associations in the engineering industry. The Electrical Development Association was launched, mainly through B.E.A.M.A. support. A year later B.E.A.M.A. initiative resulted in the foundation of the British Electrical and Allied Industries Research Association. Engineering education and training, with student scholarships, had become a part of its always expanding enterprise, and the energy and influence of the Association was making itself felt with all the Departments of the Government. Strong support was given to the setting up of the Electricity Commission and in every way the Association had established itself as a power for good.

Later, in 1924, came the setting up of the World Power Conference with the active encouragement and financial support of B.E.A.M.A. In due time a stage was reached when the Association constituted a stimulating, steadying and constructive influence in electrical manufacture, and a co-ordinating force in all the vital problems connected with the generation, transmission and utilisation of electricity, upon the right solution of which depends the industrial welfare of the nation.

So much for history, in barest outline. As to the organisation itself, membership is open to every bona fide manufacturer of electrical and allied products within the British Empire. Management and control is vested in the Council elected by members. Council committees deal with finance, exhibitions and matters of emergency, and there are nine committees, reporting direct to the Council. The latter are comprised of members who have specialised in the various subjects and are constantly at work on the following matters: Education, Export (General and Overseas Tariffs), Mining and Flameproof Enclosure, Patents, Research (Advisory), Contract Conditions, Standardisation, Tariffs (Home) and Traffic.

Serving the committees of other electrical bodies, ranging in subject from physics to economics, from steam generation to radio interference, B.E.A.M.A. has representatives linked with no fewer than twenty associations and institutions, and they serve, also, on a very large number of technical committees set up by other industries.

Owing to the wide range of manufacture covered the members are divided into sixteen sections according to classes of products. Sections may be formed by any number of members desiring to represent more particularly the interests of any branch of manufacture. While each section deals with its own particular problems the Council provides a focus for all these activities, and acts as a co-ordinating and advisory body.

Co-operation, not compulsion, is the fundamental idea. In any such organisation there must, of course, be rules, but a glance through the by-laws of the sections reveals the tolerance or elasticity allowed to individual opinion and action. Any resolution of a section in the nature of a rule or regulation which is not carried unanimously is not binding on any member voting against it. Again, non-members of the Association may from time to time be invited to attend a meeting and express their views.

The Work of the Association

Conditions of Contract.—One of the first actions of B.E.A.M.A. in the early days was the preparation in collaboration with the Institution of Electrical Engineers of Model General Conditions of Contract—the first standard text of its kind, and this work, through a permanent joint committee, still goes on, keeping abreast, by constant revision, of the changing aspects of the industry. Then came a natural development in the preparation of B.E.A.M.A. Conditions of Sale, which have proved invaluable to members. Several editions have been issued, and to-day the conditions, covering practically every type of tender, are generally accepted by purchasers and are recognised as being fair and equitable.

This work on General Conditions brought the Association into close touch with the I.M.E.A. and resulted in the setting up of a Joint Committee which has met for many years, and forms a most useful channel for discussion on any subjects of mutual interest. The work of this committee in smoothing

Elliott and Fry *James Bacon and Son*

Principal executive officers of B.E.A.M.A.: Mr. V. Watlington, M.I.E.E., Director; Mr. C. Rodgers, O.B.E., M.I.E.E., Deputy Director; the Hon. J. R. Rea, M.A., Barrister-at-Law, Secretary; and Mr. D. Maxwell Buist, M.I.E.E., General Manager, Groups Joint Administration Board

away difficulties and improving relations between manufacturers and a most important body of purchasers is particularly noteworthy.

Standardisation.—There is no branch of the electrical industry, and no industry allied in any way with it, with which B.E.A.M.A. is not linked. By far the greater part of its daily, continuous activity does not come before the notice of the electrical public as a whole. Year after year, for instance, its representatives sit on over 230 committees of the British Standards Institution, covering every aspect of the electrical engineering field, and maintaining touch with the colliery, iron and steel, building, non-ferrous metallurgical, and other industries.

Statistics.—It is a far cry from electrotechnics to economics, but no public enterprise can afford to disregard the economic forces that underlie and influence human affairs. Fifteen years ago the Association set up a special department for the examination and development of public relations, and for the study of economics in relation to industrial activity. To know is to achieve, and B.E.A.M.A. spends annually large sums in the collection and co-ordination of statistics and information—available not only to members but to all interested in electrical development. The Economic and Statistical Department is one of the important links between electrical manufacturers and the several Departments of the Government responsible for the maintenance and development of United Kingdom trade.

Overseas Trade.—Throughout the year, the Association is busy upon export matters, the negotiation of customs duties on electrical goods, and other problems affecting the welfare of members engaging in overseas trade. It has been active in advising and assisting the Government in connection with the various trade agreements with the Dominions and foreign countries that have been established during recent years. H.M. Trade Commissioners and Commercial Counsellors constantly consult with B.E.A.M.A. The Association is called upon to give evidence before Government Committees. It advises its members as to action when changes occur in the law, particularly in relation to export and import procedure, which may affect their business. Merchandise marks legislation, import and export licences, quotas, etc., call for frequent conferences with the Government Departments concerned.

Exhibitions.—Every important exhibition to-day has its electrical section. In order that members should be enabled to take part in such events in the most effective manner a close and continual collaboration is maintained with E.D.A., the general aim being to discourage the undesirable type of exhibition organised merely for the profit of its promoters, and to ensure that members shall participate only in those that will produce useful results. The benefit of the service to the public thus rendered needs no emphasis.

In the arrangement of the numerous exhibitions of more local appeal, a similar co-operation is constantly carried on between B.E.A.M.A., E.D.A., and the I.M.E.A., with the consequence that costs are shared equitably between the supply authorities and the manufacturers.

The "ASTA"

One of the most recent projects sponsored by the Association in conjunction with the Department of Scientific and Industrial Research, is the formation of the Association of Short-Circuit Testing Authorities—to take its place in the electrical alphabet as the "ASTA." Within the last few years several well-known B.E.A.M.A. manufacturers of heavy-duty switchgear have built expensive short-circuit testing stations for their own use. The D.S.I.R. was considering the establishment of a station on similar lines for testing up to 250,000 kVA at 11 kV at the National Physical Laboratory, to provide means by which any manufacturer could have his switchgear tested. In the course of friendly preliminary inquiries and interchange of views, however, it became clear that by far the best course would be to utilise existing facilities, as Great Britain now possesses better equipped testing stations than any other country. A certain amount of co-ordination of work among the firms concerned had already taken place, and the result of this voluntary nucleus is the "ASTA."

An agreement has been entered into between the D.S.I.R. and "ASTA" by which the existing stations continue to issue their own "ASTA" certificates of rating and records of performance, and, in addition, N.P.L. certificates are obtainable when required. This arrangement provides for the supervision of tests by an N.P.L. representative resident at each "ASTA" station.

The Department is also represented on the Technical Committee of the new association and further co-operation is ensured by the appointment of an Advisory Committee which includes nominees of the owners of the stations, and of firms which do not own such stations, as well as independent members selected by the Department.

This latest development is a typical example of the co-operation which is so striking a feature of B.E.A.M.A.'s work. Instead of expensive and needless rivalry and reduplication, there is team-work of the best description; many thousands of pounds are saved for other useful lines of expansion.

Price Policy

The difficult but very important matter of regulation of prices has for many years been under consideration by the members at various times. Competition, normally a healthy feature of the business world, becomes harmful when unrestricted; prices fall to an unremunerative level, and not only the manufacturer but eventually the user and the general public suffer. It was clearly obvious that much wasteful expenditure of time and money would be avoided if a reasonable arrangement could be arrived at embodying some method of price control; the problem was to devise a method that should be fair to all.

By its constitution, the Association is debarred from undertaking anything in the nature of compulsory price control. Nevertheless, it will be easily understood that with so many firms having similar interests, and coming into association through B.E.A.M.A., mutual arrangements between members might be entered into by which competition could be tempered by co-operation, the disastrous price-cutting which was stagnating the industry in the pre-war years could be eliminated and workable methods evolved by which reasonable prices should be charged for the more standardised classes of manufacture.

The Association, recognising the value of these voluntary agreements between members, used its influence to maintain a high standard of conduct, and to guide the co-operative efforts of its members in this question of price policy in a proper and reasonable manner. Mr. D. Maxwell Buist has recently been appointed to assist in co-ordinating group activities. Here it should be emphasised that membership of the Association carries with it no obligation to join any price agreement which may have been initiated by individual members with regard to some particular product.

In many ways the success of this policy has justified itself. It has substituted competition in quality for competition in price. The security given to the manufacturer has enabled him to plan for the future, to carry out valuable research not only in his own organisation but through the Electrical Research Association, and to spend profitably on schemes for educating the public in the uses of his products. To-day buyers of electrical machinery and plant recognise the mutual value that such a policy ensures. Friendly relations have been securely established, and a tribute of appreciation is due to the broadminded way in which the majority of purchasers now regard this question.

The effect of a watchful over-riding supervision by B.E.A.M.A. has been to broaden the views of the individual price groups, and it is interesting to record that the Association is frequently asked by price groups to represent their collective point of view to purchasers—a sure indication of the value of its efforts in this field. The Association has acted, in the familiar phrase, as "guide, philosopher and friend," guiding without undue restraint, reasoning wisely when necessary, and retaining that friendly spirit without which sincere negotiations become almost impossible.

Conclusion

This review describes but a few of the principal activities of the Association. To enter fully into its story would need several articles of equal or greater length. I have merely hinted at the constant progress made in the field of standardisation, and have omitted many matters of interest, such as the work done in bringing about revision of railway rates and facilities at home and abroad, to the advantage of both manufacturer and user of electrical apparatus; the work of the Education Committee; and a host of other everyday activities. Enough has been said, however, to indicate the untiring energy with which the Council and its committees carry on their fundamental policy of increasing the unity, and therefore the prestige and advancement of the electrical industry in every possible way.

The ultimate test of an organisation is the service it renders to its constituents, to its customers, to the public and to the nation. The justification of B.E.A.M.A. lies in the condition of British electrical manufacture to-day compared with thirty years ago; electrical manufacture ranks fifth among the great national industries of the country and Great Britain is now the second largest electrical exporting country in the world. In the signal success which electricity supply has achieved, electrical manufacturers can justly claim to have played their part; and in the public service, the B.E.A.M.A. policy of quality, reliability and safety has won through. Finally, in the maintenance of national security, political as well as economic, an efficient and well organised electrical manufacturing industry is an asset that cannot be ignored.

Luminous-tube Interior Lighting

By Henry A. Miller

The modern trend in illuminating technique is to provide a source of lighting which is both efficient and decorative. Until quite recently experts have been attacking the problem by concentrating on improvements in filament lamps and their appropriate fittings. It is now generally recognised, the author states, that this method will in the near future be superseded by the use of luminous discharge tubes.

SOME of the advantages of luminous tubes over ordinary incandescent lamps are that the consumption is in some cases only 60 per cent. of that of gasfilled lamps for a given value of illumination, the distribution of the light source is spread over an area instead of diverging from a point, their normal life is at least three times that of filament lamps, they radiate a certain amount of artificial sunlight and illumination is easily controlled by means of adjustable chokes.

The luminous tubes referred to herein are of the cold-cathode high-voltage type, having a wave form similar to that shown in fig. 1, which applies to tubing operated by a fully-loaded transformer, the dotted line representing the no-load voltage. Immediately after ionisation the voltage drops rapidly and high-frequency currents in the neighbourhood of 2,000 to 3,000 cycles are encountered for a part of each half cycle before a stable condition is reached. A transformer of the constant current type is therefore required.

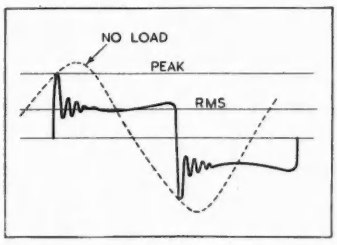


Fig. 1.—Wave form of high-voltage cold cathode tube

A considerable advance in luminous-tube lighting practice has been made possible by the development of luminescent tubes by means of which much greater light outputs can be obtained.

Tubes of one colour only are not suitable for interior lighting, since there is bound to be a deficiency in rays of at least one colour. For most situations a combination of three tubes has been found necessary for satisfactory results. The centre points of both the transformer secondary and the luminous-tube circuit are earthed, thereby ensuring minimum voltage stress.

Types of Installations

For store or factory lighting the best results are usually obtained by arranging the tubing in three-colour formation throughout the length of the ceiling. In lofty premises it may be necessary to suspend the tube sections from the ceiling by means of hanging brackets spaced at intervals, so as to bring the tubing to a height of, say, 10 ft. from the floor.

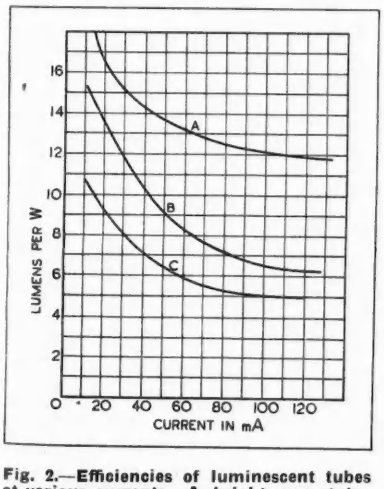


Fig. 2.—Efficiencies of luminescent tubes at various currents. A, bright green tube. B, white tube. C, blue tube

All electrodes and high-voltage connections are housed in metal cases which should be efficiently earthed. Assuming a length of 10 ft., the consumption of each section would be about 100 W and a lighting intensity of from 10 to 12 ft.-candles could be obtained.

In comparing this with other sources of illumination it should be remembered that a perfectly uniform distribution of light is provided and shadow is practically eliminated, which is generally advantageous for industrial purposes.

A similar method of lighting can be used with great success for shop windows, the triple-tube sections being fitted with suitable reflectors, which also serve to render the tubes invisible from the pavement. Discharge-tube window lighting is particularly useful for obtaining various display effects. For instance, some merchandise is displayed most effectively by light which gives prominence to either the blue or red end of the spectrum. It is then quite a simple matter to arrange the colour combination of the tubes accordingly.

Although still in the experimental stage, luminous tube office lighting is being developed with considerable success. Fig. 4 shows an installation designed for a small office with a floor area of approximately 300 square feet and a ceiling height of 10-15 feet.

A deep channel reflector is built into the ceiling equidistant from the walls and the luminous tubes are suspended therein. The channel reflector, which is treated with special white paint of high reflection factor, has a total radiating area of about 25 sq. ft.

The luminous tubing is luminescent with the exception of two single lengths of red, which provide a certain amount of long wavelength light output of the red portion of the spectrum. The resultant blending gives a soft light similar to natural daylight. In operation, the tubes are supplied by transformers with an output of 60 mA at 5,000 V.

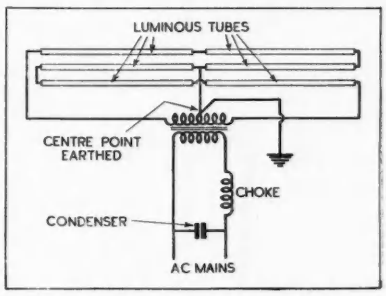


Fig. 1.—Wave form of high-voltage tube circuit

When measured with a foot-candle meter provided with a correction filter to approximate to the human eye response, a reading of 15 foot-candles is obtained. This reading is taken underneath the tubes at desk height, the minimum illumination in the middle of the room being 12 foot-candles.

On comparison with incandescent lamps used for the same purpose it is found that the installation of luminous-tube lighting results in a 40 per cent. saving in consumption.

For public buildings, luminous-tube lighting can now be supplied in units, each triple-tube section housed in galvanised-steel troughing and operated by its individual transformer. Thus the electrodes, series connections and high-voltage leads are totally enclosed and protected and electrical continuity is provided for by earthing lips welded on the end of each length of troughing.

The luminous tubes are secured by means of special phosphor-bronze clips which also serve as connections. This not only facilitates installation of the lighting units, but permits removal of the tubes for maintenance.

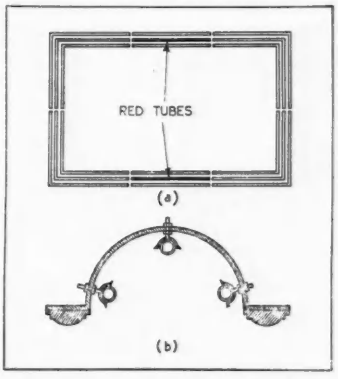


Fig. 4.—Luminous tube lighting for a small office, showing (a) general arrangement and (b) section through channel

Lead-covered high-voltage cable of the ozone-proof type should be used throughout an installation of this description, and all high-voltage feeder connections must be protected with special compounded bell-glass insulators.

The lower the voltage across a given length of tube (assuming the same current in each case), the higher will be its light efficiency, up to a maximum value which is mainly determined by the striking

potential of the luminous tube approaching the voltage of the transformer on open circuit. In practice, the striking potential of the tube should be at least 20 per cent. below the voltage (open circuit) of the transformer.

Where general lighting by means of individual rows of tubing is required, the necessary spacing can be calculated from the formula $D1 = \frac{K \times Lmax}{F1 \times Fb}$,

in which *Lmax* is the maximum lighting intensity required and *K*, *F*1 and *Fb* are values taken from the table. The diameter, current and colour of the luminous tubing are constituents of *Fb*, the comparative length of tubing is expressed by *F*1 and the factor corresponding to the vertical distance of the tubes from the plane to be lighted (A) is represented by *K*. *D*1 is an intermediate value and the distance between adjacent tubes is given by the point of intersection of the corresponding ordinates.

TABLE SHOWING COMPARATIVE UTILITIES OF TRIPLE-TUBE COLOUR COMBINATIONS.

Combination.	Resultant Colour.	Remarks.
1 red tube and 2 green	Soft pink-white	Very cheerful, suitable for cinema and theatre foyers, etc.
1 green tube and 2 gold	Warm amber ...	Suitable for display purposes unless blue is predominant colour.
1 red tube and 2 white-blue.	Pink-white ...	Colder than other combinations, but suitable for general lighting.
1 red, 1 green and 1 blue green.	Almost white ...	Applicable to indirect lighting schemes.
1 red, 1 green and 1 gold.	Pink-amber ...	Suitable for restaurants, etc., slightly deficient in blue-rays.

For example, a room measures 23 ft. by 33 ft. by 10 ft. high and general lighting of an intensity of 8 foot-candles is to be produced at a distance of 7 ft. from the ceiling, assuming that 28 ft. of white-blue luminous tubing of 22 mm. diameter and operated at 60 mA is to be employed.

Then by reference to the table $Fb = 283$, $F1 = 1.72$ and $K = 87$. Thus, $D1 = \frac{87 \times 8}{1.72 \times 283} = 1.43$ ft.

Life of Tubes

The rare gas contained in a luminous discharge tube is not consumed, but simply undergoes a temporary change with the passage of the current. Since the ions return to their normal state when the current flow is stopped, it would appear that the life of a luminous tube should be unlimited. This, of course, is not the case. The chief factor affecting the life is the process known as "hardening" during which the pressure gradually decreases and the voltage drop across the electrodes rises until eventually the tube begins to flicker. However, with carefully processed tubing flickering would not commence before at least 5,000 burning hours had elapsed. When hardening does take place, the luminous tubes can be regassed at a fraction of their original cost.

The life of a cold-cathode discharge tube may be expressed as $T = C \frac{p^x V}{i w}$

in which *T* is the time in burning hours, *p* the tube pressure (the normal value of the exponent *x* being 2), *i* is the current density, *V* the volume of the tube and *w* a function relating

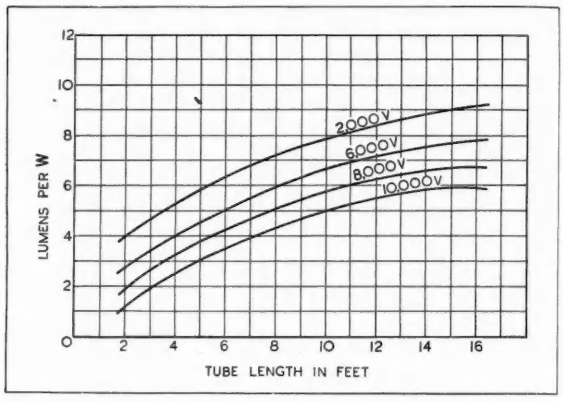


Fig. 5.—Relation of light efficiency to length of tube at different open-circuit voltages of transformer

to the periodicity of the supply. *C* is a variable quantity dependent upon the gas filling, electrode material and other details of manufacture.

An important advantage of luminous discharge tubes as used for decorative lighting is their low surface brightness. This permits their installation in full view of the public without glare.

TABLE OF VALUES FOR CALCULATION OF SPACING.

Values for Fb					Values for FL		Values for FL		Values for K	
Milli-amp.	Diam. of tube.	White-blue.	Blue.	Green	Length of tube divided by height.		Length of tube divided by height.		Dis-tance A.	K.
15	15 mm.	108	78	79	0.3	0.35	2.5	1.63	3	116
30	,,	210	159	154	0.4	0.46	3.0	1.68	5	101
60	,,	368	282	284	0.5	0.56	3.5	1.71	7	87
15	22 mm.	68	53	63	1.0	1.00	4.0	1.72	9	73
30	,,	149	107	122	1.5	1.33	4.5	1.74	11	59
60	,,	283	210	233	2.0	1.52	5.0	1.76		

In addition, they can be used to create an appropriate atmosphere. When installed in a restaurant, the colours can be separately switched so that on a hot day a bluish light could be utilised to give an impression of coolness, whilst in the winter a warm red glow would counteract the depressing influence of cold or damp weather.

IN THE COURTS

Liability for Employee's Injuries

MR. JUSTICE LAWRENCE, in the King's Bench Division on January 20th, delivered his considered judgment in the case of Fowler *v.* Yorkshire Electric Power Co. on a question of law which he had reserved for consideration in London after the trial before him and a special jury at the Leeds Assizes in July last. The plaintiff, Mr. R. W. Fowler, a plumber, of Dewsbury, brought the action against the defendants to recover damages for personal injuries sustained through the alleged negligence and breach of statutory duty of the defendants, their servants or agents.

The material facts were that in October, 1936, Mr. Fowler was working for Frank Newsome, Ltd., who were engaged in certain work at the defendants' power station. While at work he was struck by an electric travelling crane belonging to the defendants and received injuries which included the loss of his right hand and head injuries. Mr. Fowler alleged that the defendants were liable in failing to warn him of the danger; in failing to warn the driver of the crane of the work the plaintiff was doing and his presence there; and in failing to stop the crane.

The defendant company denied liability and alleged that the Mitchell Engineering Co., Ltd., was employed by them to do the work and that that company had sub-contracted the work on which plaintiff was engaged. They denied being guilty of breach of any statutory duty and also said that plaintiff had been guilty of contributory negligence.

The jury at Leeds assessed the damages to which the plaintiff was entitled at £1,250 if defendants were liable, but found that although a danger existed there was no negligence on the part of the defendants. The question of law raised was whether the defendants were responsible for the failure of Newsomes to pass on the danger warning to plaintiff.

(The case was reported in our issue of October 21st.)

His Lordship, in the course of delivering his considered judgment, said that in his opinion the travelling crane was, under the Factory Acts, a dangerous machine and as it was not fenced the plaintiff was entitled to succeed against the defendants because of their breach of statutory duty in that respect. He (the Judge) regretted the result because he agreed with the jury's finding that Newsomes' negligence to pass on the danger warning to plaintiff was the real cause of the accident. He, however, was bound in the circumstances by his decision under the Factory Acts and judgment was entered for the plaintiff for £1,250 and costs.

Railway Signal Patent Action

In the action brought by the General Railway Signal Co., Ltd., against the Westinghouse Brake & Signal Co., Ltd., for alleged infringement of the letters patent for a system of railway signalling which has been before the Chancery Division for several weeks, Mr. Justice Morton has reserved his judgment.

The alleged infringement complained of relates to a very complicated system of railway signalling which the defendants, the Westinghouse Brake & Signal Co., installed between Wembley and Stanmore. During the long hearing expert electrical engineers gave evidence for the plaintiffs, but the defendants called no evidence.

Theft Losses at South Shields

Two women and two men were each fined £2 at South Shields last week for fraudulently extracting electricity from prepayment meters. For the prosecutors, the South Shields Corporation, it was stated that more than a million kWh of electricity, valued at £1,500, was each year obtained from prepayment meters in the borough by means of the insertion of pieces of wire.

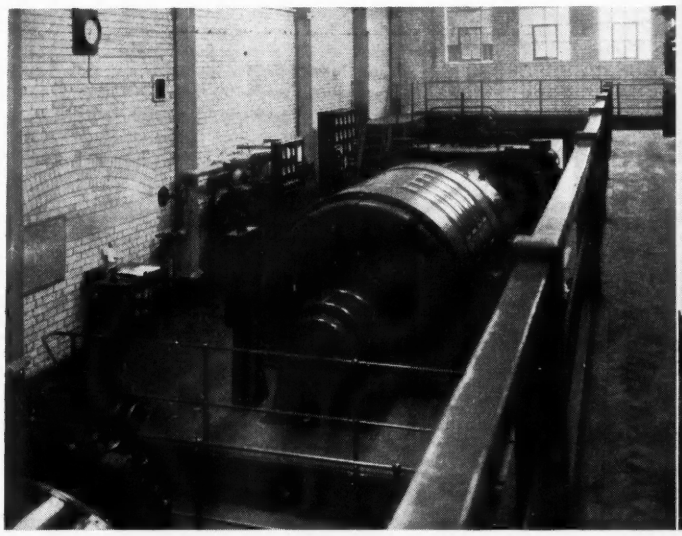
Extensions at Barrow

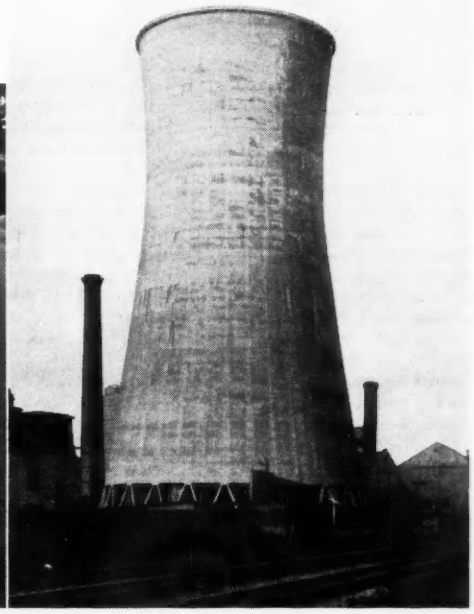
10,000 kW Added

A 10,000-kW extension at the Buccleuch Street generating station of Barrow-in-Furness Corporation (which serves an area of 210 sq. miles), bringing the installed capacity up to 24,000 kW, was officially inaugurated on January 20th. The new plant, which covers little more floor space than that occupied by the 225 kW originally installed in 1899 on the same site, was put to work only sixteen months after formal sanction had been received, although the work involved the removal of and considerable modifications to existing machinery and buildings.

The Met.-Vick. 3,000-RPM turbo-alternator generates at 6.6 kV and is designed for a maximum continuous rating of 10,000 kW at 0.8 power factor. The turbine exhausts into a Contraflo condenser with a cooling surface of 13,000 sq. ft. furnishing a vacuum of 28 in. Hg at full load when the inlet temperature of the cooling water is 80 deg. F. Mather & Platt circulating-water and condensate pumps of the vertical shaft type and Weir air-extraction pumps of the two-stage steam-ejector type are installed in duplicate. Two-stage bleeding of the turbine increases the feed-water temperature to 194 deg. F. The electrically operated duplicate-busbar metal-clad 6.6-kV circuit-breakers have a rupturing capacity of 250,000 kVA.

The new 10,000-kW set at Barrow and (right) the 1,000,000 gal. per hour cooling tower





Steam at 210 lb. per sq. in. and 700 deg. F. is provided by a new boiler with a normal evaporative capacity of 75,000 lb. per hr. (90,000 lb. maximum). Firing is by means of a stoker of the louvre type with a grate area of 252 sq. ft. A Senior gilled-tube economiser and a Howden regenerative air pre-heater are incorporated in the boiler unit. The indirect- and forced-draught fans, also of Howden's make, are vane controlled and operated from a remote instrument panel and are driven by two-speed induction motors, the lower speed being used for loads up to the normal rating. The efficiency of the complete boiler unit based on the gross calorific value of the fuel is 83 per cent. Coal handling plant of the bucket elevator and horizontal push-plate type has been installed.

A 180-ft. concrete tower, 102 ft. in diameter at base and 73 ft. at the top, has been built and interconnected with the existing circulating water system by reinforced concrete culvert and pipes. It is capable of reducing the temperature of 1,000,000 gal. of water per hr. from 96 deg. F. to 78 deg. with atmospheric conditions conforming to a wet-bulb reading of 55 deg. F.

All the alterations and extensions to buildings and the construction of machinery foundations were carried out under the direction of the borough engineer and surveyor. Plans and specifications for the extension were prepared by the former borough electrical engineer, Mr. H. R. Burnett, and the work was completed, at an estimated cost of £125,000, under the supervision of his successor, Mr. J. E. Shepherd, assisted by Mr. W. Fisher, station superintendent and constructional engineer.

The principal contractors were Vickers-Armstrongs, Ltd., turbo-alternator plant; Metropolitan-Vickers Electrical Co., Ltd., high- and low-voltage switchgear and transformers; Stirling Boiler Co., Ltd., boiler plant; Davenport Engineering Co., Ltd., cooling tower; Aiton & Co., Ltd., main steam and feed pipes; Naylor Bros., Ltd., coal-handling plant; British Insulated Cables, Ltd., high-voltage cables; Crompton, Parkinson, Ltd., low-voltage cables; Rainey Bros., Ltd., buildings and foundations.

In addition, Hopkinsons, Ltd., supplied steam and feed valves; International Combustion Co., Ltd., the stoker and ash-handling plant; Mather & Platt, Ltd., boiler feed pumps; and J. Blakeborough & Sons, Ltd., the circulating water valves, penstocks and screens.

The Inaugural Ceremony

Mrs. Morton, wife of Alderman T. Morton, J.P., chairman of the Barrow Electricity Committee, performed the opening ceremony.

At the official luncheon, 130 guests were entertained in the banquet hall, Ald. Morton presiding. Sir Charles Craven, O.B.E., who proposed "The Undertaking," presented Mrs. Morton with a silver tray and tea service on behalf of the contractors. Coun. A. W. Smith also handed to Mrs. Morton an inscribed silver salver.

Sir Charles said electricity was being generated in Barrow at less than one-tenth of the fuel consumption per unit of what it was forty years ago. Referring to the relationship between the town and the Vickers works in Barrow, he said that in regard to electricity, as in all other matters, the relations between the Town Hall and his company were excellent. He would like to see some extension of their joint undertaking regarding electricity supplies, so that if an emergency did arise, not only the people of Barrow but the works which were his private responsibility would be well protected.

Alderman Morton returned thanks on behalf of his wife for the presentation, and on behalf of the undertaking welcomed Sir Charles Craven and other visitors.

Mr. H. Rainey submitted "The Town," to which the Mayor (Alderman Massicks) replied; Mr. J. E. Shepherd proposed "The Contractors," Mr. J. S. Peck, director, Metropolitan-Vickers Electrical Co., Ltd., responding, and Councillor Asa Morton proposed "The Electricity Supply Industry," to which Major A. Graham Woods replied.

I.E.E. Certificates and Diplomas

The national certificates and diplomas in electrical engineering awarded in England and Wales by the Institution of Electrical Engineers in conjunction with the Board of Education numbered 1,423 last year, as compared with 1,328 in 1937 and 1,197 in 1936. Unsuccessful candidates totalled 1,120 against 906 and 817 respectively.

Meetings and Discussions

Last week's I.E.E. paper and the subsequent discussion on the design of fractional horse-power induction motors provided a valuable contribution to published data on this subject. Opposite views were expressed on one or two points, including the use of enamel covered stator wire. At a meeting of the A.M.E.E. the need for a more suitable trailing-cable screen was mentioned, and some interesting comments on machine-tool operation were contained in a symposium of papers presented to the Institution of Mechanical Engineers last week.

Design of Small Motors

INCREASING diversity in the applications of fractional horse-power motors, particularly the single-phase type and the severity of the operating conditions, together with the invariable demand for low manufacturing cost, necessitate accurate design methods capable of being used with confidence in place of the trial and error procedure so prevalent in the past. In such terms as these Mr. N. F. T. Saunders introduced his paper (to which reference was made last week) at the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 19th.

Mr. D. B. Hoseason opened the discussion with the remark that in order that the I.E.E. records might be complete they should not neglect such a small unit as the fractional horse-power motor. From the monetary aspect it represented a large proportion of makers' outputs and needed much more design with less mathematics than did larger machines. He was unable to agree with the author's formula for the end windings, and he had had great difficulty in relating some of the expressions in the author's formulæ for deriving single-phase performance. His experience was that brake test efficiency might be five points lower (not two points higher) than when determined by summation of losses. Regarding slot combinations, difficulties with crawling and defective acceleration could be intensified by excessive application of mathematics, which tended to become the master instead of servant. Improvements might be obtained by skewing rotor bars one stator slot pitch, not rotor pitch as was advised in text books.

Importance of Reliability

Mr. A. G. Salisbury said the paper should dispel the impression that this class of motor was a sort of toy; actually it needed to be as carefully designed as its bigger brothers. He regretted the inclination to follow the American tendency to reduce cost by means which might affect reliability. The "capacitor-start" motor was ousting other types, but the reduction of the size of the condenser might lower reliability; also a built-in thermal cut-out was another item which might go wrong, so the need for such additional complications was debatable. Remembering that voltages in this country were double those used in the United States, cotton or silk covering (which could be impregnated) would be additional protection for enamelled stator wires and might be preferable to forcing a little more copper into the slots.

Mr. J. E. Macfarlane agreed that the skewing of rotor bars did materially reduce noise. His experience was that aluminium rotor windings produced erratic results. If enamelled wire needed further protection, it might be covered with paper. Mr. H. G. Poxon approved the suggestion that enamelled wire was not really satisfactory, except for the cheaper motors. With cotton or silk covering there would be less liability to break down. Would the author really have chosen enamelled wire if cost had not been the deciding factor?

Dr. E. Rosenberg confirmed the author's preference for enamelled wire, which, he said, was excellent for the purpose and several makers now produced reliable grades. Two such wires together could be subjected to 3,000 V, which one would not think of doing in the case of cotton-covered wire. The design of small motors would be much easier if, instead of the odd sizes now made, a series in geometrical progression could be standardised; if makers of wire (enamelled or otherwise) would keep diameters within closer tolerances; and if stampings could be obtained without burr. If ½ and ⅛ HP motors were made of equal lengths and diameters, would not the difference between their prices disappear? The skewing of rotor bars would not produce the same results in all motors, some of which would not respond to that method of treatment, while the resulting need for insulating the squirrel caging would increase the cost and also affect the rating.

Mr. H. J. Eleg asked whether the advantages to be gained by annealing laminations after stamping would permit the burr-removal operation to be dispensed with. Dr. J. E. Parton referred briefly to difficulties encountered in driving teleprinters.

Mr. G. E. Middleton described the paper as the first of its kind and hoped it would not be the last, since fractional horse-power motors were being demanded in ever-increasing numbers. The windings of large machines could be adjusted after completion, but the design of miniature motors must be dead right from the first, as makers could not afford to have any appreciable proportion of complaints. Noise reduction was of increasing importance, especially in domestic applications. Pulsating torque was inherent in single-phase machines, and the resulting vibration might be transmitted all over a building; it could be absorbed only by resilient mounting. The space factor of enamelled wire depended upon the care exercised by operators when winding. His chief criticism of enamelled wire was that the enamel might be softened by the impregnating varnish; therefore it should be covered. A copper bar rotor was splendid electrically but a nuisance in the shops, as joints had to be made with care in order to minimise noise. A cast aluminium rotor was superior, both in performance and from the manufacturing aspect.

Mr. N. F. T. Saunders, in reply, was most emphatically of the opinion that American-made fractional horse-power motors were first-class products. He was equally sure of the suitability of enamelled wire, the use of which was desirable quite apart from cost. Softening of the enamel by impregnating varnish could be avoided by the exercise of such care as the previous speaker appeared to have given to cast aluminium rotors. Skewing rotor bars was desirable, but not sufficient; care was needed in selecting slot combinations. Small motors were not temperamental; the fact was that not enough was known about them.

Cables for Mines

SOME of the problems associated with mining cables that still await solution, such as the need for the development of a more suitable trailing-cable screen, are referred to in the paper by Mr. D. F. R. Milner (Liverpool Electric Cable Co., Ltd.) which was read before the Yorkshire North-West Branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS at Wakefield on January 14th.

The several types of cable specified in B.S.S. No. 708 are referred to, it being pointed out that a screened cable, particularly if operating on an earth leakage protected system, is less likely to continue alive while in a dangerous condition than an unscreened cable, and such open sparking as might take place is more limited in intensity and duration. In practice, however, an individually screened cable is likely to be more expensive to maintain on account of its greater failure frequency, resulting from the dielectric thickness between phase conductors and earth being only one half of that in a collectively screened cable. Then, again, repairs to cores are somewhat more difficult to carry out.

Some engineers object to the risk of the screens being worn away by frictional contact with the centre earth conductor. But in the author's experience these fears are not borne out in practice, as he has known such cables to be intact after six years' use. He suggests that symmetry in design is not the only goal to be aimed at. A B.S.I. committee is now considering the design of drill cables and the C.M.A. is investigating the fireproofing of cable insulation.

Forms of steel armour of much more flexible construction than the types mentioned in B.S.S. No. 708 are available, and have been used not only for conveyor and loader cables, but also for fully flexible cables. It is claimed that a flexible steel armour forms a better mechanical protection than tough rubber alone, but its extra weight and limited bending radius appear to discourage its more general use. Both wire and tape armour tends to open when the cable is severely bent, and to remedy this a design has now been evolved in which V-section galvanised steel strips are so applied as not to gap when the cable is bent. It would seem that an armour of this description would do much towards eliminating the damage resulting from shot firing.

The potential danger of "spiralling" or "corkscrewing" is indicated by the fact that the core can "elbow" and penetrate through the screen. The pitch of the spirals is uniform and the maximum effect is at the machine end, gradually diminishing towards the gate switch. The cause is generally rough treatment, but of what particular sort? The author and Mr. B. Wright have investigated this baffling problem and offer an

explanation. For example, bending a short length of four-core cable into a semi-circle of small radius will cause two of the cores (on the outer circumference) to recede within the sheath and the other two (on the inner circumference) will protrude from the ends. But if the cable contains two complete lays there will theoretically be no displacement of the cores at the ends, for the reason that each core will be of equal length on the inside and outside of the arc formed by the cable axis, so that relative movement between the cores will be neutralised under such conditions.

The more lays there are in the bend, the less will be the relative movement of the cores, because the difference between inner and outer arc lengths is inversely proportional to the number of lays. In a trailing cable the extra length of outward core movement will be accommodated somewhere along the cable, dependent upon the tightness or otherwise of the outer sheath. Such movement tends to travel along toward the coal cutter end, for there the component parts of the cable are looser in the sheath due to continual handling. The cores on the outside of the bend will pull themselves toward the cable axis and take up any slack in their length, again more readily done from the machine end. This to and fro movement of the cores cannot go on indefinitely and, as the cable is secured at the pommel end, it is eventually arrested. When a core thus reaches the limit of its extension it will buckle and form an "elbow."

This action is not absolutely reversible, the cores having unequal stresses imposed upon them. Those that take the greatest tend to straighten and lose their lay, so that the others revolve round them as an axis, thus causing spiral "corkscrewing." To so shorten the lay of cores as to permit such bending to occur without twisting would involve lengthening the conductor, perhaps as much as 75 per cent. This would correspondingly increase the resistance, but this is not considered to be prohibitive, since trailing cables are usually of short length. Cables made up in this manner are now undergoing extensive trials and the author considers them to be promising.

Machine-tool Practice

A SYMPOSIUM of nine papers on machine-tool practice was presented for discussion at the INSTITUTION OF MECHANICAL ENGINEERS in London on January 20th.

Mr. J. Gordon Lang (John Lang & Son, Ltd.) described the production in batches of twenty-four at a time of precision spur gears with ground teeth varying in pitch diameter from 2 in. to 24 in. Electric resistance furnaces with fully surrounded elements were used for heat treatment and for preheating blanks. They were pyrometrically controlled to within ± 5 deg. F.

Mr. T. P. N. Burness (Ruston and Hornsby, Ltd.) declared that for boring holes with precision in Diesel engine fuel-injection equipment it was necessary to employ a first-class electric hardening and tempering furnace, thermostatically controlled. A great deal of the trouble experienced with this work could be traced to distortion during and after heat treatment.

Mr. W. Alderson (Butler Machine Tool Co., Ltd.) described planing, shaping and slotting machines. He stated that the shifting belt drive was still the cheapest for small machines and its simplicity might, under some conditions, be a deciding factor, but there were many difficulties in trying to make such mechanisms work satisfactorily at high speeds and over a wide range of speeds. The main features of motor drives were the fine gradations of speed obtainable and enormously increased facility of control.

Ward-Leonard Drives for Planers

By far the majority of planers were now driven by reversing motors with some form of Ward-Leonard control, but even with this if a high return speed were selected the maximum power might not be available on the cutting stroke at ordinary speeds. Such loss of power might not be serious for light cuts, but the capacity for heavy cutting was reduced by abnormally high return speeds. It was fundamentally wrong to use table speeds so high as to require a bigger driving motor than was needed for the maximum cuts the machine would make. A high-speed machine could be arranged to give maximum power at low speeds by the use of more gear power, but it should be noted that the return speed had to be reduced, thus stressing the argument put forward.

The disadvantage of all reversing motor drives was the stored energy of the armature. Although much of this energy might be returned to the line, it was essential that it should be kept as low as possible by reducing the speed of revolution to the economic limit and using specially designed machines with armatures of small diameter. Planers were now being built with motors of only 15 to 150 RPM, coupled directly to the single worm driving the table. A magnetic clutch and even a belt drive with aluminium pulleys had even less stored energy in the reversing members, but there was no possibility of returning any of this energy to the line as with the Ward-Leonard control.

The magnetic clutch drive was suitable for all sizes of machines and was for some reasons to be preferred for special machines of the portable type, but to obtain the fine gradations of speed which had been stressed as an advantage of the reversing motor drive the use of a variable-speed DC motor was necessary. Even with this extra capital outlay the overall speed range was not equal to that of the Ward-Leonard drive.

The most common alternative to the latter system was the straight DC variable-speed motor. For continuous heavy cutting on materials which limited the speed range a DC motor giving full power output over its speed range of 4 :1 might be the most economical drive.

Mr. J. L. Hall (Kendall and Gent, Ltd.) dealt with heavy milling machines driven by variable speed motors, a feature of which was accessibility of the controls, largely actuated by push-buttons. It was necessary to provide means for automatically cutting off the power supply to the feed mechanism in the event of the speed of the cutter spindle decreasing.

In pointing out the special features of light milling machines Mr. I. H. Wright (James Archdale & Co., Ltd.) drew attention to the manner in which all motor controls were grouped within convenient reach of the operator from his normal working position.

Mr. H. H. Asbridge (Churchill Machine Tool Co., Ltd.) described how one of the outstanding changes in the design of grinding machines had been the substitution of electrical and hydraulic mechanism for the change-speed gearboxes of small and medium sizes. This had made almost fully automatic operation possible and enabled the higher finishes now demanded to be more easily achieved with a smoother drive for repetition work. For large machines remote push-button control of all motors from the operator's position was provided.

Mr. S. J. Harley (Coventry Gauge & Tool Co., Ltd.), explained how forming screw threads by grinding necessitated specially designed motors with generating sets and controllers for infinitely variable speeds.

Merits of Anthracite Duff

THE use of anthracite duff for steam generation is the subject of a paper by Mr. E. B. Johnson (Amalgamated Anthracite Collieries, Ltd.) that was read before the INSTITUTE OF FUEL in London on January 24th. The paper contains precise details of the chemical and physical characteristics of several types of Welsh duffs. It compares British and foreign installations, including a summary of published test results, and gives information about new work not previously covered.

Both pulverised fuel and chain-grate methods are considered. The author mentions that the number of outstanding proposals for new works in the western region of the South Wales industrial area to include duff-burning boilers leaves no doubt about the proved and now accepted merits of this fuel for steam generation on a small or large scale.

Mechanical and electro-mechanical methods of duff blending are briefly explained, this system being said to bring about unexpected savings and other advantages beyond the anticipated reduction in steam cost. Reference is made to what is believed to be the first power station to operate satisfactorily with duff and washed coal on the sandwich system for two 40,000 lb. chain-grate boilers. The saving in cost per kWh generated may be judged from the fact that this station now operates on these boilers continuously, whereas formerly it ran for two shifts on six days and only a few hours on Sundays.

Need for Improved Lighting

THAT the standard of illumination in modern houses is exceedingly low and could be improved by electricity supply authorities giving personal attention to householders, thus benefiting not only themselves but also makers of fittings and lamps, is the view expressed in a paper by Mr. J. B. Harris that was read before the London Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on Friday last week.

For offices the recommended values are 10 to 15 ft.-candles in place of often prevailing values of 4 to 5 ft.-candles. The author seems to advocate indirect lighting in conjunction with local desk lamp in preference to rows of bright opal-glass pendants which, he suggests, cause a disturbing effect when workers look up from their desks.

For street lighting the author says it is fairly well agreed that discharge lamps should be utilised in preference to fila-

ment lamps; and that the most recent impetus is due to the ever-increasing use of floodlighting and other forms of outdoor illumination for industrial occupations and advertising.

Progress in Electro-deposition

RECENT developments in electro-deposition were discussed at the January informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London.

Mr. A. W. Hothersall, president of the Electro-depositors Technical Society, displayed charts to indicate the wide range of the subject. Beyond a bare mention of the deposition of colloids, such as rubber and lacquer, his opening remarks were confined to electro-metallurgy. He described the building up of worn parts of steel shafts and explained how the same technique had been applied to the rifling of gun barrels.

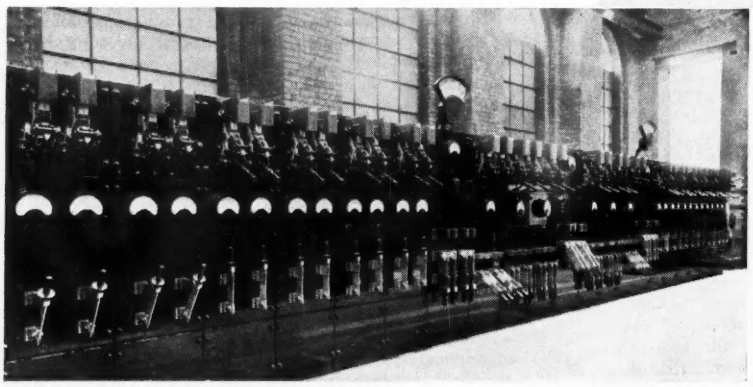
The electrical extraction and refining of metals was described and electro-deposition as applied to the formation of printing and gramophone matrices was touched upon, also the less known applications for the production of gold leaf and other metal foils and the "plating" of glass for reflectors. It was stated that the shortage of metals in Germany had led to the production of a large number of articles made of plastics which could be very effectively coated with various electro-deposited metals.

FORTHCOMING EVENTS

Institution of Electrical Engineers.—Thursday, February 2nd. Institution, London, W.C.2. 6 p.m. "The Empire Service Broadcasting Station at Daventry," by Messrs. L. W. Hayes and B. N. MacLarty.

Wireless Section.—Wednesday, February 1st. Institution, London, W.C.2. 6 p.m. "Electrolytic Condensers," by Messrs. P. R. Coursey and S. N. Ray.

Meter and Instrument Section.—Friday, February 3rd. Institution, London, W.C.2. 7 p.m. "The Electrical Protection of Cold-cathode Luminous Discharge-tube Installations," by Mr. H. M. Barlow. "An Electrostatic Analyser for Complex Waves of Small Amplitude," by Prof. J. C. Prescott.



North Midland Centre.—Friday, January 27th. Grand Hotel, Harrogate. Annual dance.

Tees-side Sub-Centre.—Wednesday, February 1st. Cleveland Technical Institute, Middlesbrough. 6.45 p.m. "The Lighting Load—Its Characteristics and Development," by Mr. W. J. Jones.

East Midland Sub-Centre.—Friday, February 3rd. Grand Hotel, Leicester. Annual dinner.

Sheffield Sub-Centre.—Friday, February 3rd. Royal Victoria Hotel, Sheffield. Annual supper-dance.

Illuminating Engineering Society (*Public Lighting Section*).—Friday, January 27th. Royal Society of Arts, 18, John Street, Adelphi, W.C.2. 7 p.m. "Design of Street Lanterns," by Messrs. J. Bertram and R. Maxted.

Birmingham Electric Club.—Monday, January 30th. Grand Hotel, Birmingham. 7 p.m. Presidential address by Mr. J. Hamilton.

Association of Supervising Electrical Engineers.—Tuesday, January 31st. Electricity Showrooms, The Headrows, Leeds. 1. "Industrial Electric Heating and Air Displacement," by Mr. F. L. Fletcher.

Diesel Engine Users' Association.—Wednesday, February 1st. The Connaught Rooms, Great Queen Street, W.C.2. 7 for 7.30 p.m. Annual dinner.

Junior Institution of Engineers.—Friday, February 3rd. 39, Victoria Street, S.W.1. 7.30 p.m. "The Layout and Electrical Equipment of Swimming Pools," by Mr. C. N. Bond.

Faraday House Old Students' Association.—Friday, February 3rd. Thames House Restaurant, Millbank, S.W.1. 8 p.m. Annual dance.

Wages in the Cable Making Industry

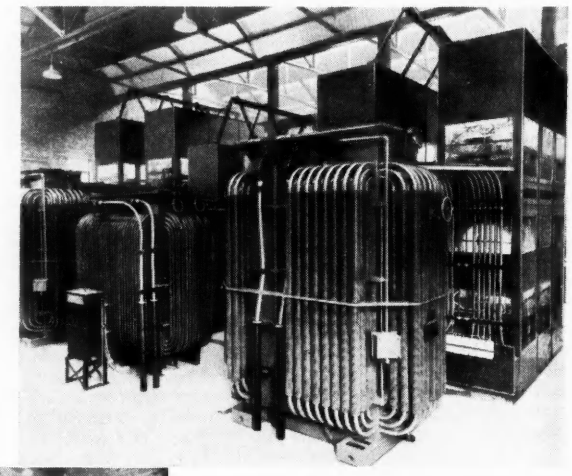
The Joint Industrial Council for the Electrical Cable Making Industry announces that the December 31st cost-of-living figure (55 per cent. above the 1914 level) will not involve any alteration in wages on the third pay-day in February.

Large Rectifier Sub-station

Total capacity 7,000 kW

WITH the switching in of two 2,500-kW banks of rectifiers by the Mayor of Shoreditch (Ald. J. Abrahams) on January 14th, the Evelyn Walk sub-station of the electricity undertaking with a total capacity of 7,000 kW became the largest glass-bulb rectifier installation in the world and one of the three largest with any type of rectifier in Great Britain, the second being the 6,500-kW sub-station of the same authority in Hearn Street.

A compact industrial area (about one sq. mile) is served by a rotary convertor sub-station from which three automatic unattended rectifier sub-stations are remote controlled; a fourth is to be put into service later. High-voltage supply is



The Evelyn Walk sub-station at Shoreditch showing the Hewittic rectifiers. On the left is the DC distribution board designed and installed by the same company

taken at 6.6-kV either from the C.E.B. or else from the Corporation's selected station at Whiston Road. Each of the new rectifier equipments consists of an O.N. induction high-voltage regulator, a 3/12-phase zig-zag O.N. transformer and twelve bulbs in two-tier double-bulb cubicles, facing one another with a gangway between and with a platform for the higher tier. Cubicles and gangway occupy a floor space of 12 ft. by 12 ft., and there is 3 ft. of head room.

In each cubicle are also fuses, equalising coils, DC isolator, exciter and fan. In the transformer tanks come the interphase transformers, auxiliary transformers, and fan choke controls. The regulators are motor-operated and afford, at any load, DC voltage variation between 480 and 520. Off-load tapping switches on the transformers also provide adjustments of ± 2½, 5 and 7½ per cent.

A reactor on the primary side of each transformer absorbs the surge current on switching in on a dead network; it is then shorted by a circuit-breaker, which also opens in case of severe overload, thus inserting the reactor to limit the loading. The high-voltage switchgear controlling the incoming feeders and the rectifiers has a rupturing capacity of 250,000 kVA.

Constant indication of the DC bus-bar voltage at the rectifier sub-stations is provided at the controlling sub-station, and pilot lamps show the position of switchgear and other equipment. Push-buttons give individual control of each circuit breaker, induction regulator and reactor switch, but all DC breakers and reactor switches can be closed by one button only.

Tests show the following percentage efficiencies at various loads: 5/4, 92.5; 4/4, 93; 3/4, 93; 2/4, 92; 1/4, 91.5. Overloads of 25 per cent. for two hours and 200 per cent. for peaks can be carried. As the 12-phase connections give a smooth DC output, no further circuits have been found necessary to avoid inductive interference with radio or communication circuits. These rectifiers, as well as the remainder of the 18,500-kW installed in the borough or on order have been, or will be, supplied by the Hewittic Electric Co., Ltd., and installed under the supervision of Mr. P. C. Ebner, the borough electrical engineer, or his predecessor, Mr. W. Weekes. Some of the plant has been in service for ten years, but the original bulbs are still in use and have needed no repairs of any kind.

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Thermal Overload Protection

WITH reference to Mr. N. L. Cavallo's letter in your issue of January 20th, I think the objection to the thermostat reclosing to start the motor under conditions which might be dangerous can be overcome by the application of a thermostat which remains open until reset by hand. A thermostat of the bimetallic type is now available which meets the conditions envisaged.

Mr. Cavallo suggests that the protection should be added to the switchgear, but this is now generally agreed not to be ideal as the motor may be mounted in a much hotter position than the switchgear, and unless the protection is mounted in the motor itself, there is always a serious danger of a burn out. A. SHERWIN.

January 21st. SALFORD ELECTRICAL INSTRUMENTS, LTD.

[The thermostat referred to is described on p. 131 of this issue.—Eds., ELEC. REV.]

The Furring Problem

In connection with your report on the admirable paper read by Mr. J. I. Bernard before the I.E.E. on January 5th on domestic water heating, and the discussion thereon, I was particularly interested in the remarks of Mr. C. H. Smith. As a pioneer of indirect heating by water as applied to electric water heaters, I entirely agree with Mr. Smith that this is the only way to stop "furring" entirely. I do not agree with him, however, when he says that this method is not practical in the case of the smaller heaters, due to lack of space in the containers.

In the case of a 1½-gallon heater, an indirect heating chamber of adequate dimensions can be accommodated by increasing the diameter of the tank by a little more than ¼ in., or in an existing heater by reducing the capacity by less than 2 pints. Mr. Bernard says, quite rightly, that it is in the smaller heaters that scaling is most serious. A good deal of this scaling is directly due to boiling at the top of the heaters, owing to temperature "build up," where small quantities of water are drawn at frequent intervals. In the indirect heater, no boiling can occur, whatever the conditions of use.

The long and very thin element suggested by Mr. Bernard is a solution of only one aspect of the problem, *i.e.*, accumulation of scale on the element itself. But the scale is still there; it falls to the bottom of the heater and often builds up in such a way as to cause trouble by forcing apart the element sheath and/or thermostat and outlet pipe, particularly in the smaller heaters.

In conclusion, it cannot be emphasised too strongly that the heating medium in indirect heaters, as Mr. Smith said, *must* be water. ALAN WRIGHT.

London, W.C.2.

Cooker Replacements

While a splendid maintenance service is provided by many supply authorities for hired cookers, what of the unfortunate consumer who has *bought* his cooker? If he is lucky enough to have purchased a make and model similar to that let out on hire by the local supply authority, he can generally count on as good a service as his neighbour who hires a cooker. But there are many different makes and types of cooker, each with a number of different kinds of element; even in different models of the same type, the elements are often non-interchangeable owing to improvements effected from year to year. The average contractor cannot possibly hope to keep a representative stock of cooker spares, especially when several voltages are involved.

Now this would not matter in the least if manufacturers maintained an efficient and rapid replacement service, and encouraged their agents to do the same. A careful record of the replacements necessary for obsolete types of cooker would enable the correct replacement for a griller element for an old cooker to be sent by return, so long as the order gave the model and serial number appearing on the name plate.

After some years of experience I feel bound to say that, with a few notable exceptions, cooker manufacturers appear to have no record of (and even less interest in) the types of element fitted to their obsolete or obsolescent cookers.

The usual procedure is to write to the factory for the spare (showrooms rarely bother themselves about spare parts), and a day or two later a card arrives asking for an old one to be sent as a pattern. After several days of telephoning and writing (with luck) the correct replacement is received.

In most cases it is useless to apply to manufacturers' agents for spare parts for a cooker more than a year or so old, for the contractor well knows that the agent will simply pack up the pattern and send if off to the makers, thus wasting a few more valuable hours.

The above remarks may also be applied to rotary switches as fitted to electric cookers. Again, there are several different makes and many different types, and the switch makers generally appear to be ignorant as to which type is fitted to a particular make and model of cooker. The removal of the defective switch for a pattern usually leaves two live ends of solid wire protruding through clearing holes in the sheet metal case of the cooker. As these are not easy to insulate and leave in a safe condition, a certain amount of dismantling is often necessary in order to disconnect them and leave the remainder of the cooker working.

Where the defective part is a boiling plate, the loan of a portable boiling ring will generally minimise the inconvenience to the consumer, but little can be done when the oven or griller is out of commission. I know of several cases where an auxiliary gas oven or cooker (always installed and maintained at very low rates by the gas company) has been installed by the consumer after experiences of this kind.

Although the majority of cooker consumers are using hired appliances, and the above causes of complaint do not concern them, nevertheless one dissatisfied consumer can do irreparable harm. I have no wish to minimise the splendid publicity put out by the E.D.A., manufacturers and supply authorities to "boost" electric cooking, but I would earnestly suggest that the elimination of the forms of inefficiency outlined above is at least as important as the acquisition of new cooker consumers. JOHN BLAND.

Edgware, *January 16th.*

Sub-stations on Consumer's Premises

A consumer in a large town having about 200 HP installed, partly AC and partly DC, has gone to great trouble in building alterations and extensions to accommodate new plant and now the supply authority states that he must have a sub-station and take a high-voltage supply. At present there is less than 50 HP on the AC system and about 25 to 30 HP additional will eventually be required.

There is no room for a sub-station and the consumer would like to know what his position is. Must he give floor space for the sub-station which will house the high-voltage switchgear and transformer and which, although it is his premises and he pays the rates, is yet occupied by the supply undertaking for its equipment? Has the consumer no powers to extend on the three-phase, 400-V, 50-cycle supply or must he submit to the supply authority?

Incidentally, the high-voltage supply will mean a change-over of the DC plant to AC. The undertaking will give a grant towards this although it is more anxious to put in a rectifier and this would take up more space. I would like your readers' views on what the consumer's position is with regard to high- and low-voltage supplies. NO ROOM.

January 20th.

"It's an Ill Wind . . ."

I am in agreement with "Anti-Panic" regarding the effect of the recent cold snap on the maximum demand of supply authorities generally, particularly those who are compelled to purchase their requirements from the grid. Several supply engineers seem convinced that the method of charging adopted by the C.E.B. in respect of grid supplies operates unfairly in certain circumstances, but there are others, including myself, who see little amiss with either the circumstances or the grid tariff, but who firmly believe that the adverse financial position likely to arise for many as the result of the cold snap is due to obvious shortcomings in the domestic tariffs operated by the undertakings themselves.

There is nothing to be gained by blinking the fact that with a properly constituted domestic tariff, cold snaps would bother nobody except those consumers utilising the service for exceptional requirements, but with present-day forms of domestic tariffs the consumer is in a position to increase his m.d. *ad lib.* without any corresponding increase in the amount of his bill. But surely the point is that it is the consumer and not the C.E.B. who should bear the cost of the extra kilowatts demanded to offset the effects of cold snaps, &c.

One thing which the cold snap has made unmistakably clear for all is the folly of purchasing bulk supply on a basis of so much per pound and then selling to domestic consumers at

so much per yard. That is what really happens when the question is properly considered. Cold snaps in winter are not unusual and the position which has now arisen can recur at intervals and if we are to eliminate speculation from the business of domestic supply, it is very evident that the selling tariffs to domestic consumers must employ the same construction as the buying tariff.

This principle is fully recognised in the case of industrial supplies and undoubtedly affords the supply authority sufficient cover against any sort of risk likely to be encountered in practice and for that reason it does not seem right to assert that because the principle has been sacrificed in the case of domestic supplies, the financial responsibility attaching to abnormal use of the service during the recent cold spell ought to rank for credit by the C.E.B.

I am mindful that the view expressed is not likely to prove very popular with supply authorities generally, but the other aspect of the matter seems to be that if cold snaps should occur again the price of domestic electricity supplies might suffer an all-round increase instead of increased charges to those consumers responsible for sudden and unprofitable increases in the m.d. charges. JAMES RATCLIFFE, A.M.I.E.E.,
January 22nd. *Engineer and Manager,*
Whitworth U.D.C.

High-rupturing-capacity Fuses

Referring to "Contact's" letter under the above heading in the ELECTRICAL REVIEW of January 13th, experience as a manufacturer of this class of gear has shown that the price of h.r.c. cartridge fuses compared with that of the re-wireable fuse is largely brought about by users themselves.

The value of the short-circuit kVA that is obtainable at any given location may be roughly grouped as follows:—

Situation	Available fault kVA	Occurrence, per cent.
A	25,000	5
B	From 12,500 to 25,000	20
C	Up to 12,500	75

In spite of the fact that Situation A conditions are rare, users of cartridge fuses for Situations B and C always specify Situation A performance. As "Contact" pointed out, the testing charges of this type of fuse are extremely heavy, which makes development costly and raises the price of the product.

One of the main aims of my company is to produce reliable tested cartridge fuses at reasonable cost, but this policy is handicapped by the practice of users in specifying 25,000-kVA test certificates for requirements where such conditions cannot prevail. As a result we are obliged to sell them the more expensive article which they actually do not require.

C. S. LAWSON,
Director, Lawson Beck, Ltd.
Gateshead-on-Tyne, *January 21st.*

Qualifying Plumber-jointers

It may be of interest to your correspondent Mr. Maskery to know that in Queensland, Australia, no man can secure a post as jointer without having first passed a practical and theoretical test for which an official certificate is issued. Linesmen come under similar regulations, and I think the procedure applies in the other States also. F. J. WORNHAM.
Wembley, *January 21st.*

Sagging of Overhead Lines

I shall be interested to learn if any of your readers have encountered the following anomaly arising from the application of the Electricity Commissioners' new regulations for small overhead lines, particularly under conditions of minimum sag.

A sag curve plotted for 7/14 steel (22 deg. F., no wind, no ice) will give quite satisfactory results in level country, but if used to span a valley with supports at different levels the dip may appear to be several feet worse than that with full wind and ice loading. In a case in point, for a span of 650 ft. with a difference in support level equal to 60 ft., the theoretical maximum sag is 15 ft., theoretical minimum sag 9 ft., and the latter value from the sag curve 18 ft.

Whilst the difficulty arising from this can be overcome, any observations as to the reasons for its appearance in these particular circumstances would be appreciated. SURVEYOR.
January 23rd.

Commercial Education

In response to the invitation of Lord Herbert Scott (chairman of the Commercial Education Committee), Lord Ritchie of Dundee (chairman of the Port of London Authority) is to present the scholarships, medals and prizes to the successful candidates in the commercial education examinations of the London Chamber of Commerce. The awards will be presented at the Mansion House on March 2nd, when the Lord Mayor will preside.

Here and There

By Nomad

SOME of the most interesting jobs I have investigated have been electricity supply load-building activities, and I have been particularly struck by the greatly varying ideas which prevail as to what is meant by load building. One widely held idea is that load building is just salesmanship from the purely commercial aspect and I submit that this idea is entirely wrong and is likely to lead the industry into serious difficulties. Writing in the house journal of W. T. Henley's Telegraph Works Co., Ltd., Mr. A. T. Bullen, engineer and manager of Welwyn Garden City Electricity Supply Co., Ltd., points to the type of difficulty I have in mind. Referring to the danger of reducing the unit rate to a very low figure he says that a result is the too rapid development of certain services which imposes on undertakings added maximum demand charges brought about by new peaks or the alteration of peak times.

* * *

Some years ago when it was almost a national cry that the supply section of the industry wanted "commercialising" the idea was born that not until the purely "chief engineer" type of manager for supply undertakings was replaced by the purely commercial mind would the supply section make the headway to which the advantages of electricity over other services entitled it to make. I am afraid that such an opinion is still strongly held, but I am opposed to it because such fundamentals of supply engineering training as tariff adjustment, and the attainment of high load factor and diversity, coupled strictly with economical generation and distribution, represent an absolutely essential foundation for a sound load-building outlook.

* * *

It may not be too wide of the mark to define load building as an outlook, but the view obtained is one of many aspects. Although it has been written, apparently, for the non-electrical man, I would strongly recommend every load builder or prospective load builder to read a booklet called "Why do the prices charged per unit of electricity vary, when the quantity of energy contained in each unit is the same?" written by Mr. R. P. Sloan, C.B.E., chairman and managing director of the North Eastern Electric Supply Co., Ltd. In it the author says that what is really sold is a service, or the undertaking of certain work and duties on behalf of each consumer.

* * *

Without the idea of service "in his bones," then, the load builder will not be successful; service cannot be rendered satisfactorily without enthusiasm. We have heard too much of the unenviable lot of the supply engineer. Mr. W. B. Woodhouse, managing director of the Yorkshire Electric Power Co., once talked load-building to me for two solid hours and I found that his enthusiasm for the work was as great as the technical ability for which he is renowned. He was asked how he kept abreast with his many-sided developments and his simple but obviously sincere reply was—"I am so tremendously interested in it all. I have found the idea of service ingrained in every one of the several Y.E.P. staff members I have met and that idea of service is expressed forcibly in every industry which the company serves by way of actual scientific research into the non-electrical or process problems of consumers and prospective consumers, showing in the long run, of course, how electricity can 'serve better'."

* * *

It is a fact that such sales research in collieries is resulting in a growing tendency for the coal industry to look upon electricity supply as a distributor of coal in another form rather than as a competitor. I agree that this is an exceptional case, but it expresses admirably an essential aspect of true load building and helps me to show the difference between load building and mere salesmanship, which every successful load builder must feel.

* * *

The load-building outlook is also expressed in other ways—often from personal angles I suspect. For instance, at Hull some time ago, I found Mr. J. N. Waite, then chief engineer, and his staff all directing their energies round the pivot of diversity. I think the experiment at the Sutton Trust housing estate by which a figure of 25.5 was established for domestic diversity is a really important contribution to "load-building technique." It is because of its conception and appreciation of the great importance of load building that the ELECTRICAL REVIEW is attempting to show in the case of selected undertakings the "outlook" rather than a record of achievements, and I believe that in this attempt lies another important contribution to the good work.

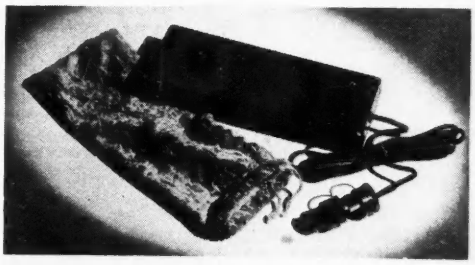
NEW ELECTRICAL PRODUCTS

A review of equipment recently marketed

A Bed Warmer

AN all-bakelite thermostatically-controlled bed warmer known as the "Chilcheeta" is the latest product of GRAHAM FARISH, LTD., Bromley, Kent.

The equipment is suitable for voltages of from 150 to 250 AC or DC, and the temperature maintained is from 110 to 120 deg. F. The size is 11 in. by 4½ in. by 1¼ in., and the heater is supplied complete with 9 ft. of flex and a combined two-pin plug and lampholder adaptor, as well as a velvet cover.

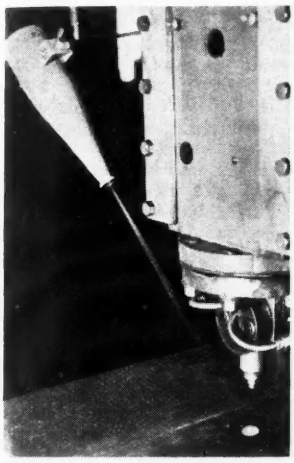


The "Chilcheeta" bed warmer

A Welding Spot-light

To facilitate the exact positioning of spot welds PHILIPS INDUSTRIAL, 145, Charing Cross Road, London, W.C.2, have produced a new welding spot-light. The spot-light combines, in a cylindrical metal housing, a step-down transformer, a special bulb rated at 1 A at 2.5 V, and a high-quality lens giving an intense and concentrated beam of light. At a distance of about 10 in. from the work, a light spot approximately ¼ in. in diameter is produced, bright enough to be clearly visible in daylight. The spot-light is fitted on a universal mounting bracket to facilitate its attachment.

The operator has only to position the work so that the light beam falls exactly on the marks previously made to ensure that the welds will be located accurately. In the case of work requiring long rows of spot welds in one line, the use of two spot-lights can materially speed up the operation. The light is also valuable when handling small articles, such as the welding of handles to pans.



The Philips spot-light for welding in use

Electric Tools

A large number of new electric tools have been added to their range by S. WOLF & Co., LTD., Pioneer Works, Hanger Lane, Ealing, London, W.5.

Most of these are connected with the reconditioning of automobile engines. There is, for instance, a complete valve seat servicing kit driven by a small universal motor with a spindle speed, running light, of 17,000 RPM and capable of driving valve seating stones of up to 2 in. in diameter. The overall length is 6⅞ in., and the weight 4 lb. The valve seat grinder is also obtainable by itself.

The ⅝-in. wet and dry precision valve refacer will take valves with heads up to 4 in. in diameter. Two motors are provided with a full load rating of 480 W, one for driving the grinding spindle and one for the Collet spindle. A special feature is the self-contained wet grinding pump.

The "Mobilectric" engine workshop is a complete engineering workshop equipment on wheels for private cars and light lorries. It includes apparatus, all of course, electrically driven, for refacing valves, grinding valve seats, decarbonising, "hotting-up" and drilling up to ¼ in. in steel and ⅜ in. in wood. Other work which can be done is cleaning or burnishing valve heads and guides and removing rust and scale. An adjustable lamp standard provides adequate light at the bench and a socket is provided for connecting a hand-lamp, or a hand grinder or other portable tool. The motors of the valve refacer and the duo synchro machine are of the universal pattern.

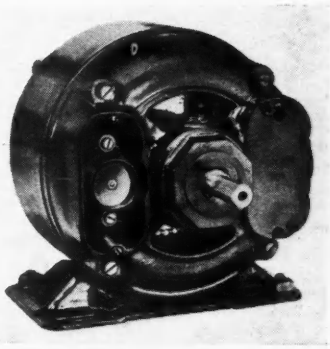
Another new tool is the "KSM" heavy duty portable sander designed for sanding, grinding and cleaning operations on metal and wood. The speed and loading are 4,000 RPM, 265 W running light, and 2,600 RPM, 530 W on full load respectively.

The new "WPM" ball-bearing polisher has been produced for rubbing down and polishing lacquer on motor bodies, furniture, &c. On load it runs at 925 RPM, and at 1,250 RPM when running light.

The type "GM7" tool post grinder is fitted with a ½-HP fan ventilated motor, running at a speed of 2,850 RPM.

Manually Reset Thermostat

We have received from SALFORD ELECTRICAL INSTRUMENTS, LTD., Peel Works, Silk Street, Salford, 3, Lancs, particulars of a thermostat that has been designed to guard against the danger referred to in our Correspondence section ("Thermal Overload Protection.") The operating member is a bi-metal disc which is dished, thus giving a quick and definite make and break action. The device is mounted in the motor frame and has to be reset by hand before the motor can be restarted. Slow rises of temperature, such as those due to overloading, will cause the thermostat to function, and stalling or failure to start when the supply is switched on will result in the circuit being opened within 15 sec. Under these conditions the heater in the thermostat begins to glow, operating the bi-metal disc before the motor case has become warm. As the characteristic of the thermostat follows closely that of the motor windings, the rating of an existing standard motor could be slightly increased by the addition of this form of protection.



The Salford manually reset thermostat fitted to a motor

The new Wolf "KSM" sander, valve-seat servicing kit and "Mobilectric" engine workshop

Hydro-electricity in Madras

Important Industrial Load

SINCE hydro-electric development was started in Madras there has occurred a substantial betterment of industrial conditions. In 1929 the Pykara scheme for supplying power to the Nilgiris and Coimbatore districts was sanctioned, and a supply to the latter area was made available in 1932. Considerable opposition was encountered in negotiating the change-over of the existing mills to electric drive, but the uphill fight was won, and besides the existing eight mills taking a supply from Pykara many others were established in consequence of the availability of cheap power. Now there are twenty-eight mills connected, with five more under construction and four registered. Besides the textile mills there is a cement factory which is the State Electricity Department's largest individual consumer with a demand of 2,000 kW, while a new rubber factory has recently been completed. Tea estates also provide a good outlet for power, the number connected having increased by three to thirty-two during the past year. Agricultural pumping has great possibilities, but due to nervousness as to the effect on sub-soil water levels the Government ordered that electric pumping should be restricted to wells in existence prior to June, 1934, and situated outside the area commanded by the Lower Bhavani irrigation project. Nevertheless, the development of this class of load has been most encouraging (from 61 HP in 1933-34 to 5,927 HP in 1937-38). In addition, energy is supplied for rural street lighting, domestic and small industrial purposes. In the past year thirty-one villages were connected, bringing the total to over 400.

The demand on the Pykara power station has continued to grow steadily until the full capacity of the plant was reached. In 1933-34 the peak demand was 3,150 kW and the energy generated 10.9 million kWh. In the past year these figures have risen to 16,500 kW and 82.4 million kWh. Of the 35,050 kW connected at the end of March last 15,400 kW was due to the textile industry, representing an increase of 23 per cent. during the year. Agricultural and miscellaneous consumers had 7,600 kW connected (32 per cent. increase) and tea factories 3,350 kW (22 per cent. increase).

In 1936 a review of the needs of the Pykara area indicated that additional generating plant would be required by 1939, even after the transfer of the Erode-Trichinopoly-Negapatam area to the Mettur system, the first generating unit of which was put into commission and paralleled with the Pykara system in June last year. A scheme was therefore put in hand for extensions at Pykara comprising a third penstock pipe and two 12,500 kVA generating sets which are expected to be brought into operation by April next.

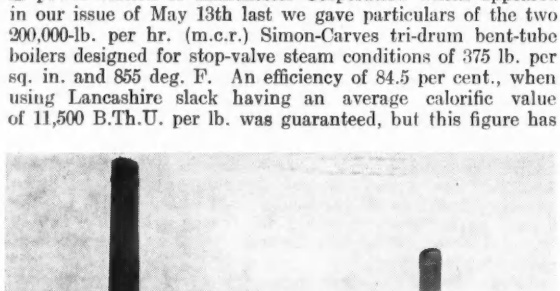
Even so, only the fringe of the enormous industrial and general potentialities of the Presidency has yet been touched. In view of the approaching completion of the Pykara and Mettur projects, the Papanasam scheme was prepared. It is designed to develop the power resources of the Tambraparni River in the Tinnevelly district. The initial cost will be Rs 179 lakhs, rising to Rs 258 lakhs, and work was begun last June.

The programme for 1938-39 comprises the extensions at Pykara, with a change-over from 66 to 110 kV transmission between Singara and Coimbatore; completion of the Sembatti-Periyakulam line; commencement of bulk supply to Villupuram, Conjeeveram, Pakala and Tirupati; inauguration of Vizagapatam and Bezwada thermal power plants; and construction work on the Cocanada central station and connected transmission lines. Most of the equipment and machinery specifications for the Papanasam project will be prepared and issued, and the plant should be brought into initial operation by June, 1941. The survey for the Pykara line to the west coast will be completed and an estimate submitted.

With regard to electrical development in general, it is stated that the majority of licensees are still only interested in areas where a substantial immediate profit can be realised. To assist in the development of rural areas the Government in 1935 agreed to bear the cost of such extensions subject to a return of 12½ per cent. being guaranteed, a form of loan now being used considerably and which it is hoped will become more popular in the future. Major H. G. Howard, the chief electrical engineer, has for some years advocated the formation of an electricity board or commission to control development, and a committee appointed to consider the suggestion reported in 1936 that this might be desirable at a future date, but did not recommend the creation of such a board at once. Subsequent experience has further convinced the Department of the necessity for some such control, and it is also considered that the time has now arrived when the Department should adopt a more energetic commercial policy.

Boiler Test at Manchester

IN the description of the 51,500-kW extension at the Barton power station of Manchester Corporation which appeared in our issue of May 13th last we gave particulars of the two 200,000-lb. per hr. (m.c.r.) Simon-Carves tri-drum bent-tube boilers designed for stop-valve steam conditions of 375 lb. per sq. in. and 855 deg. F. An efficiency of 84.5 per cent., when using Lancashire slack having an average calorific value of 11,500 B.Th.U. per lb. was guaranteed, but this figure has been exceeded in the official twenty-four hour test on No. 14 boiler by 1.75 per cent.



The Barton power station of Manchester Corporation

On this test an average of 25,270 lb. of dry slack was used per hr. with a c.v. as fired of 11,270 B.Th.U. per lb. to a thickness of 6½ in. and with the chain grates travelling at 44 ft. per hr. The approximate analysis of the fuel gave the following percentage values: Moisture, 9.3; volatile matter, 34.2; fixed carbon, 50.3; absolute ash, 15.5. Ultimate analysis returned: Moisture, 9.32; C, 62.40; H, 4.28; S, 1.59; N, 1.15; O, 7.21; ash, 14.05. The ash contained 4.6 per cent. of combustible matter.

Flue gases at the boiler outlet contained an average of 14.9 per cent. of CO_2, 4.21 per cent. of O, and 80.89 per cent. of N; corresponding figures for the air-heater outlet were 12.46, 6.66 and 80.88. Average temperatures of the gases on leaving the boiler were 707 deg. F., economiser 444 deg. F. and air heater 240 deg. F., and their mean specific heat was 0.24. With a rise of air temperature of 258 deg. F., the air in the stoker windbox averaged 343 deg. F.

Draught at gas exits (in. w.g.) was 8.81 for air heaters, 5.55 for economiser and 2.04 for boiler, while over the fires it was 0.10 in. Air pressure under the grates was maintained at 1.31 in. Energy consumption by the two f.d. fans amounted to 99.7 kWh, by the two i.d. fans to 212.2 kWh, and by the secondary-air fan to 20.2 kWh; the two stoker motors took 3.7 and the two air-heater motors 2.7 kWh. The total heat loss was equivalent to 2.02 per cent. of the gross efficiency.

Some 207,500 lb. of water was evaporated per hr. with a temperature of feed to the economiser of 301 deg. and to the boiler 390 deg. Steam pressure at the stop valve was 363 lb. (gauge) at which the temperature was 862 deg., giving a superheat of 414 deg. Heat added to steam (boiler, superheater and economiser) amounted to 1,184 B.Th.U. per lb. Heat transmitted per sq. ft. of heating surface in B.Th.U. per hr. worked out at 8,263 from the boiler, 6,533 from the superheater and 1,246 from the economiser. With 47.5 lb. of fuel fired per sq. ft. of grate per hr., 8.21 lb. of water was evaporated per lb., equivalent to 9.67 lb. per sq. ft. of boiler heating surface (10.01 from and at 212 deg.). Air used (10.16 lb. per lb. of fuel) and weight of gases (11.78 lb.) were 1.205 and 1.25 of the theoretical quantities.

Percentages of heat transferred per lb. of coal were 62.21 to water in boiler, 17.55 to steam in superheater and 6.49 to water in economiser, giving an efficiency of 86.25. Of the remainder, 3.93 per cent. was carried away by dry products of combustion, 0.83 was in the form of unburnt carbon in ashes and 3.8 heated the steam formed by hydrogen, while 0.15, 0.92 and 4.12 per cent. was accounted for by heat lost in ducts between heaters and stokers, by evaporation of moisture in fuel and by radiation, &c.

The Contractors' Dinner

Relations with supply authorities

BREVITY marked the speeches at last Tuesday's dinner of the Electrical Contractors' Association and its allied organisations at the Savoy Hotel. The company numbered about 500 and the President, Mr. Walter Riggs, M.I.E.E., who occupied the chair, read a telegram from Lord Hirst regretting his inability to be present.

Following the loyal toast, Mr. V. Z. de Ferranti, M.C., chairman of B.E.A.M.A., proposed the health of "The Allied Associations and Honorary Officials." In the course of his speech Mr. de Ferranti said that the manufacturers valued the contractors as partners in the great task of spreading electricity throughout the land and pointed out that in the last ten years the number of workers engaged in the wiring and installation trade had almost trebled. He doubted if the activities of the contractors, great and small, were fully realised. They were responsible for the installation of plant in many large undertakings, but, after all, it was in the houses of the people that we must look for the greatest development. This was primarily the work of the contractor who was in the closest touch with the public.

The manufacturers could not fail to support any movement for the improvement of electrical service and they looked to the contractors to substitute competition in quality for competition in price. Manufacturers sometimes envied the contractors their sheltered industry in which they were not exposed to the icy blasts of foreign competition. He then referred to the good work which Mr. Riggs had done for the Association and said that while they could command the services of such men they would go on from strength to strength.

"Square Deal" Wanted

In his response Mr. Riggs said that much had been heard lately of "square deals." He thought that nobody present would deny the need for a national square deal for the contractors—the "Cinderella" section of the British electrical industry. Eight million homes in this country had been wired and most public buildings were already substantially electrified. It seemed to be lost sight of, however, that the electrical contractor was responsible for the vast bulk of this work. He was in the field before public electricity supply became generally available and had thus provided the very foundation of the present electrical progress.

He did not suggest that the contractors should now rest on their oars: saturation point in electrical installation work was still in the distant future. But he claimed that the fine record of the installation trade entitled it to a square deal from all other sections of the industry, the Government and the public. They had obtained a square deal from their manufacturing friends. The provision and organisation of a recognised scheme of square dealing was necessarily a slow educational process, but in spite of this a comprehensive and detailed Fair Trading Policy had been evolved and was making real progress so far as concerned the manufacturers, wholesalers and contractors.

They did not, however, enjoy a similar square deal from certain bodies within the electricity supply industry, although there were many supply authorities—company and municipal—which maintained the best and most businesslike relations with their local contractors. But when national agreement was attempted with such bodies as the Incorporated Municipal Electrical Association and the Association of Electric Power Companies, they seemed to encounter such a multitude of hazards and bunkers as to render effective play practically impossible.

Authorities Accused of Price Cutting

Turning to labour matters, Mr. Riggs referred to the training schemes evolved by the Association and to the efforts made to maintain harmonious relations with employees. In this connection he deprecated the practice of some supply authorities in cutting the rates agreed with the E.T.U.; he was confident that Parliament had not granted electricity suppliers a monopoly to enable them to cut out the private installation trader and electrical retailer, still less to cut down the standard of living of the operative. There was certainly a need for a national square deal here.

While individual enterprise and initiative were praiseworthy, in present-day circumstances the general well-being of the trade must be put above mere personal or individual advantage.

He stood amazed at the avowed intention of certain supply authorities to "chase the contractor out of their territories," and asked what would it profit the supply industry if it gained the whole world and in doing so lost the revenue provided by the successful businesses of private traders, both large and small, in the electrical and other industries. Just as the financial strength and might of this country was built up on the private trade and enterprise of the past, so also would it be maintained and developed in the future.

In a brief speech, Mr. L. C. Penwill, Director of the Associations, proposed the toast of the Electrical Industries Benevolent Association. He said that the toast had been introduced to bring to the notice of members and guests the work and needs of this important organisation. Lord Meston thanked Mr. Penwill of the E.C.A. for their kindly thought and said that the electrical industry being comparatively new did not enjoy the amenities possessed by some of the older industries in the way of pensions and assistance to unfortunate members.

Good Relations with Operatives

Mr. H. M. Drake (past-president) proposed the health of the guests and expressed the company's regret at the absence of Dr. A. P. M. Fleming, President of the I.E.E., on account of influenza. In mentioning a number of the principal guests he referred particularly to the presence of Mr. E. W. Bussey, President of the E.T.U., because their relations remained on such a friendly footing as to constitute an object lesson to other industries.

The first response to the toast was made by Sir Cyril Hurcomb, chairman of the Electricity Commission. In the course of an amusing speech he said he felt that Lord Meston and Brig.-Gen. Legge had come in disguise. While ostensibly they represented the E.I.B.A. and E.D.A. they were really electricity supply men and it was the supply authorities' views which the contractors wanted to hear. Mentioning the Central Electricity Board, he said that all would sympathise with that organisation in the troubles it had had during the recent cold snap and the outrages which had been directed against its system. The contractors said that they wanted a square deal, but what they really needed was a triangular deal, the sides of the triangle being the contractors, the supply authorities and the public. And, he thought, the triangle should be an equilateral one. All enlightened members of the supply industry recognised that the contractor had an important part to play and he hoped that during the coming year their deliberations would lead to satisfactory results.

Services in Buildings

Sir George Lee (immediate past-president, I.E.E.) said that he was deputising for Dr. Fleming. Referring to the great expense involved in "cutting away and making good," he dealt with the advantages of underfloor ducts to which, he said, architects should give more attention. He also thought that proper schedules of procedure should be drawn up so that contractors working in buildings would not overlap. The British Standards Institution was taking up the question of services in buildings.

A reply to the toast was also made by Brig.-Gen. R. F. Legge, C.B.E., D.S.O., chairman of the British Electrical Development Association, who said that he had always held that the electrical contractor was one of the electricity suppliers' best friends. His companies never competed with the contractors and they had a schedule of prices from which they never departed. All sections of the electrical industry had been doing their job well and they hoped that they would be allowed to continue without interference, although they recognised that there must be some measure of public control.

The chairman's health was proposed by Mr. F. W. Marshall and Mr. Riggs made a brief reply.

Testing Switchgear

IN October last the Department of Scientific and Industrial Research announced that arrangements were being made for testing switchgear in stations owned by members of the Association of Short-Circuit Testing Authorities under conditions which would permit the issue of National Physical Laboratory certificates. The detailed arrangements have now been completed and the Department is ready to receive applications for tests on circuit-breakers. Tests will normally be carried out to the short-circuit requirements of B.S.S. No. 116, Part 1, 1937, and will be limited to the ratings covered by that specification, subject to a maximum voltage of 11,000 and a maximum rating of 250,000 kVA. Applications for tests should be addressed to The Director, National Physical Laboratory, Teddington, Middlesex.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

AT the sixth annual Christmas party held recently by the Bognor Gas & Electricity Co., Ltd., **Mr. H. W. Seymour,** chairman of the directors, presented long-service certificates to Messrs. H. A. Harding (chief electrical engineer), F. G. Isaacs, F. Ingram, H. T. Drinkal, F. J. Lord and S. Pay on their completion of twenty-five years' service.

Mr. Frank Nicholls, for the past eight years borough electrical engineer to the Derby Corporation, has been unanimously recommended for the post of electrical engineer and manager of the Leeds City Electricity Department to fill the vacancy caused by the death of Mr. C. Nelson Hefford. His salary will be £1,800 a year. Mr. Nicholls, who is fifty-two, was educated at Battersea Polytechnic, receiving his engineering training with Jas. Simpson & Co. at London and Newark. Subsequently he gained experience with John I. Thornycroft & Co., and between 1906 and 1912 was a marine engineer with the Royal Mail Steam Packet Co. For two years he served as charge engineer to the Heston & Isleworth Electricity Department under Mr. P. E. Rycroft. During the war he joined the R.N.D., and took part in the Gallipoli operations in 1915. In 1917 he joined the Birmingham Electricity Supply Department as charge engineer and remained there until 1919, when he became boiler house superintendent at Derby. In 1924 he was promoted to the position of generating engineer, and was appointed deputy borough electrical engineer in 1926, becoming borough electrical engineer four years later. Mr. Nicholls is an associate member of the I.E.E., and a member of the Institute of Fuel and of the Institution of Marine Engineers.

[*Lafayette*

Mr. F. Nicholls

Mr. E. J. Robertson, B.Sc.Tech., A.M.I.E.E., youngest son of the late Mr. J. A. Robertson, M.I.E.E., M.I.Mech.E., and brother of Mr. G. A. Robertson, borough electrical engineer of Preston, has left the English Electric Co., Ltd., and has joined the staff of the Associated Electric Vehicle Manufacturers, Ltd., as a technical sales engineer. Educated at St. Bees, Cumberland, and the Faculty of Technology, Manchester University, Mr. Robertson received his technical training under his father, with the Manchester Corporation and with the Metropolitan-Vickers Electrical Co., Ltd. (Manchester and Sheffield). After a year in the drawing office of the Met-Vick general engineering department, in 1934 he joined the English Electric Co., and since 1937 has been acting as personal assistant to the chief engineer and manager of the traction department.

Members of the Elliott Long-Service Association recently held their annual dinner. The guests were received by **Mr. L. W. Smith,** managing director of Elliott Bros. (London), Ltd., and Mr. Hart, president of the Association. The toast of "The Firm" was proposed by Mr. P. Clarke, Mr. R. O. Smith replying.

Mr. Peter Bennett, president of the Federation of British Industries, has been nominated for a second term of office. Sir Ernest R. Canning, Sir Alexander Roger and Mr. Ernest T. Walker have been nominated as additional vice-presidents.

Mr. H. M. Dowsett, principal of the Marconi School of Wireless Communication, Chelmsford, and one of the early English pioneers in wireless communication, retired last week after forty years' service with the Marconi Co. A farewell luncheon was given at Chelmsford by the directors of the company over which Mr. H. A. White, chairman and managing director, presided. Mr. H. M. Dowsett was born in London in 1879, and received his technical training at Finsbury, under Professors S. P. Thompson and John Perry. He obtained practical experience with the B.T.H. Co. at the St. Pancras power station, and with S. Z. de Ferranti. He joined the engineering staff of the Wireless Telegraph and Signal Co., now Marconi's Wireless Telegraph Co., Ltd., in 1899, and during that year was associated with much important development work at the Haven, South Foreland, Wimereux and Dover.

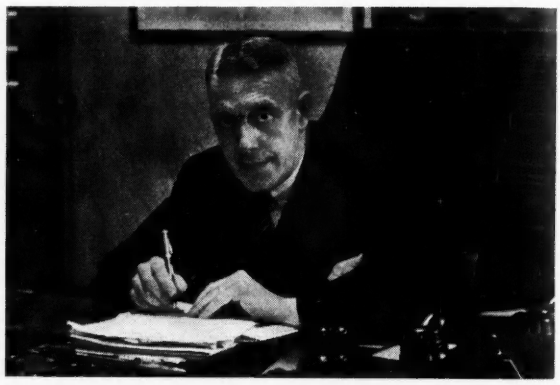
[*Lafayette*

Mr. H. M. Dowsett

He assisted in fitting H.M.S. *Europa*, this being the first practical trial given to wireless in the British Navy. Soon after he left with five other engineers and material for six portable stations to join the forces operating against the Boers. In 1901 he assisted in the erection of the Calvi station, Corsica, and carried out a demonstration for the French Government of double transmission and reception on one aerial over 120 miles to the mainland, using coherer receivers. The first motor-car portable station at Chelmsford was one of the next objects of his attention, and in 1904 he established the first commercial press service. Many subsequent installations in the Channel Islands, Australia, and Tasmania, were due to his initiative. In 1908 he was appointed head of the Marconi testing department, holding the position until 1927, when he was appointed personal assistant to the technical general manager. He became research manager in 1931.

Some 200 persons were present at the annual dinner and dance of the Lothians Electric Power Co. held recently in Edinburgh. In proposing the toast to the company Mr. E. Lamb, president of the Edinburgh City Business Club, pointed out that with the exception of Musselburgh, Dalkeith and North Berwick all the company's 700 sq. miles of supply area was without electricity prior to 1924; it was now available within a reasonable distance in all parts. Much of this progress was due to the foresight, ability and energy of Mr. H. C. Babb, the general manager. Mr. B. G. Spendiff, chief engineer of the National Electric Construction Co., Ltd., replied on behalf of the company.

Mr. J. Harwood Lumsden, M.I.Mech.E., chief engineer to the Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board, the recent progress of which is described on pages 115-7, first joined the staff of the Board in 1919 as assistant engineer at the old Tame Valley generating station. After receiving his technical education at the Sunderland Technical College, he served his apprenticeship with Richardsons, Westgarth & Co., Ltd., Sunderland. In 1908 he was appointed



Mr. J. Harwood Lumsden

junior charge engineer to the National Electric Supply Co., Preston. Subsequently he had four years' marine experience, gaining the Board of Trade first-class certificate, and then three years with the British Thomson-Houston Co., Ltd. Later he became boilerhouse superintendent to the Shropshire, Worcestershire and Staffordshire Electric Power Co. He was appointed chief engineer to the Stalybridge Board in 1929.

At the recent annual dinner of the Electrical Contractors' Association of Scotland, a report of which appears on another page, **Mr. Walter Finlay,** who recently retired from the office of general secretary of the Association, was presented with a portrait of himself painted by Mr. Donald Moodie, together with a refrigerator and a "Magicoal" fire.

We regret that the name of the new chairman of the Yorkshire Electric Power Co. was incorrectly given in our last issue. He is **Sir R. Geoffrey Ellis, Bt.**

At the annual dinner of the North-Western Centre of the I.E.E., held last week at the Midland Hotel, Manchester, **Mr. J. M. Kennedy,** deputy chairman of the Electricity Commissioners, appealed for co-operation with the Commissioners in investigating the economic possibilities of bringing up to the standard voltage those undertakings that were supplying energy at less than 230 V. Approaches had been made to the various associations representing the industry, he said, and with their concurrence and advice the Commissioners had issued a questionnaire to the various engineers and undertakings concerned. In regard to A.R.P., there was to be a national reserve of transformers, switchgear and other plant, and all engineers concerned had been informed of the conditions of emergency in which that reserve of plant might be utilised, how it could be best brought into use, and what preliminary conditions were necessary for doing so. A committee had also been dealing with fire investigations, which

were a serious and urgent problem, requiring the co-operation of engineers in the interests of the industry as a whole. Mr. George Balfour, M.P., who submitted the toast of "The Institution," commented on its rapid progress not only numerically, but in the service its members had given in the realms of discovery, invention and research. The dinner was presided over by Mr. W. Fennell, chairman of the Centre.

Mr. D. Bellamy, general manager of the Hull Corporation Electricity Department, has been proposed for election as a companion of the Institution of Electrical Engineers.

Mr. W. Lewis Smith has been appointed manager of the P.G. wire and cable department and the wiring sundries department of the General Electric Co., Ltd., and **Mr. C. F. A. Dobson** has been appointed manager of the conduit department. Hitherto these three departments were under the

Mr. W. Lewis Smith

Mr. C. F. A. Dobson

control of the late Mr. M. Levenger. Mr. Lewis Smith and Mr. Dobson have been associated with the G.E.C. for fifteen and twenty-four years respectively, and each has specially concentrated on the marketing of the products which he will now have under his personal supervision.

The annual dinner of the British Institute of Engineering Technology, the British Tutorial Institutes and British Institute of Sales Promotion was held on Tuesday last at the Café Royal, Regent Street, W. **Mr. H. Hill,** chairman of the board of directors, presiding. The occasion was essentially a social evening, and speeches were of secondary importance. Mr. T. L. Jones, who proposed the toast of "The British Institutes," in a brief speech mentioned that the Institutes now had a staff of 250, and they had achieved a success without parallel. He referred to the remarkable percentage of successes gained by students and paid tribute to the staff, to whose harmonious working he attributed a great deal of the success of the Institutes. Mr. Hill responded. Following the dinner there was an excellent cabaret and dancing.

About 800 members of the staff of M.K. Electric, Ltd., of Edmonton, attended the annual staff dance on January 20th, at the Royal Theatre of Dancing, Tottenham, N. In spite of the numbers, the spacious floor was at no time unduly crowded, dancing continuing without a break from 7.30 until midnight. Several novelty numbers were included, one of these being a wheelbarrow race, in which the ladies had to make a circuit of the dance floor pushing their partners in wheelbarrows. Prizes were given for this and also for spotlight competitions and these were presented to the winners by Mrs. C. L. Arnold, wife of the general manager.

We are pleased to learn that **Mr. H. D. Denman,** managing director of the Sloan Electrical Co., Ltd., is making good progress after an attack of pneumonia.

"Bats in the Belfry," the comedy by Diana Morgan and Robert Macdermot, provided the C.I.E. Players (a section of the Sports and Social Club of the Central London Electricity, Ltd.) with an excellent opportunity for showing their ability this week for two nights at the Fortune Theatre. Without undue flattery we can say that the performance was one of the best we have seen and Mr. G. W. Marchant is to be congratulated on such a polished production. All the actors were word-perfect and there were none of those uncomfortable silences which one usually associates with amateur shows. Major honours must go to Olga Bingham for her really excellent portrayal of the character of Miranda Baile, but she was ably supported by the rest of the cast which included Eric Stroud, Edward Knight, Joan Whitgift, Arnold Metcalfe, Stella Hildebrand, Philip Cryer, Muriel Foulds, Walter Gentry, F. G. Kendrick, L. Rose, N. Baker and Mary Dennis.

We are glad to learn that **Mr. C. H. Yeaman,** city electrical engineer, Stoke-on-Trent, who recently underwent a rather serious operation, is now home again, although we understand it will be some weeks before he will be able to resume his normal duties.

The annual dinner of the East Midland Area of the Electrical Power Engineers' Association was held at the Black Boy Hotel, Nottingham, on January 21st, **Mr. A. P. Hayes** (chairman) presiding. Proposing the toast of the Association Mr. J. Minto, chairman of the Leicester Corporation Electricity Committee, said that the electricity supply industry had a great future. Its progress had only just begun, and it had in front of it not only the task of completely revolutionising industry as a whole, and of making domestic and social life much better than it had ever been before, but also of providing the means whereby greater leisure and more wealth might come to the people as a whole. There were no troubles in the industry that could not be settled by peaceful negotiations across the table, and in the East Midlands they had always met these difficulties in a reasonable spirit. In reply, Mr. L. Hoskison, president of the Association, said that with the extension of the industry greater skill would be necessary, and it was only by constant attention to technical details and technical education that they could expect to attain anything. "The Guests" was given by Mr. W. A. Jones, general secretary of the Association, and Ald. A. Sturgess, chairman of the Derby Corporation Electricity Committee, replied.

That the local branch of the E.A.W. had contributed in no small measure to the increase in the consumption of electricity for domestic purposes was stated by **Mr. T. Bloore,** borough electrical engineer for Sutton Coldfield, when speaking at the second annual dinner of the branch in the Town Hall on January 19th. Mrs. T. Bloore, who is chairman and vice-president, presided. Miss H. C. Gibbs proposed the toast of "The Royal Town of Sutton Coldfield" and the Mayor (Councillor J. J. Ogley) responded. Alderman G. F. Pearson proposed the toast of "The Electrical Association for Women," to which Miss C. Haslett (director) replied.

Mr. M. J. H. White, at present in the Finchley Borough Council Electricity Department, has been appointed mains assistant to the Cannock U.D.C. Electricity Department.

Mr. F. H. Peacock, general manager and engineer to Cleethorpes Corporation Transport Department, has been appointed chief engineer to the Bombay Electrical Supply & Tramways Co., Ltd.

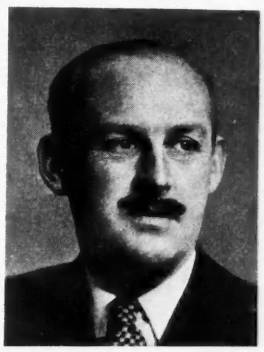
Mr. W. H. Fuller, A.M.I.E.E., has resigned his position with the Hallamshire Electric Co. His present address is 77, Holmhirst Road, Sheffield.

Mr. W. F. G. Moran has been appointed representative of McMichael Radio, Ltd., for that portion of Yorkshire north of and including Leeds and York, in succession to Mr. F. H. R. Law, who has severed his connection with the company. Mr. Moran has for some years been on the staff of the Rochdale Electric Co. His present address is 51, Windsor Road, Thornley Park, Denton, Manchester.

OBITUARY

Mr. F. Robson.—We regret to report the death on January 17th at Leatherhead, of Mr. Frank Robson, late of the Eastern Telegraph Co., Azores, Cape Town, &c. He was sixty-nine.

Mr. J. F. H. Colyer.—We regret to announce the death on January 19th of Mr. J. F. H. Colyer, A.M.I.E.E., contract manager of W. T. Henley's Telegraph Works Co., Ltd. Mr. Colyer, who would have been fifty in May, entered Henley's service in January, 1905, as a junior in the contract department. In 1910 he went to Barbados to take control of contract work for the company, and in 1914 and 1915 he was in Shanghai in a similar executive position. Among recent contracts which he controlled were those in South Wales, particularly for the Powell Duffryn Co.; Belfast; G.I.P. Railway, India; Fulham; Brisbane; Central Argentine Railway; and Cape Town; as well as many for the grid. He was a director of the Holborn Construction Co. and of the Antrim Electricity Distribution Co., and the Antrim Electricity Supply Co. In addition to the family mourners there were present at the funeral service at Golders Green Crematorium on January 23rd the following directors of W. T. Henley's Telegraph Works Co., Ltd.: Sir Montague Hughman (chairman), Mr. W. F. Bishop, Sir Maurice Simpson, Mr. Wm. McClelland, and Sir Edward Crowe, together with Mr. A. H. M. Jacob (secretary) and a large number of Mr. Colyer's business friends and colleagues on the Henley staff.



Mr. J. F. H. Colyer

Mr. F. Galton, of the outside sales staff of the Edison Swan Electric Co., Ltd., died recently at the age of sixty-five. Previously a member of the staff of Trollope & Colls, Ltd., Mr. Galton joined the Edison Swan Electric Co., Ltd., in 1913 and became responsible for the lay-out and electrical installation of the London branch showrooms, then at Queen Victoria Street, E.C. This work was completed just before the war, during which he was transferred to the Victoria Street depôt as manager. Ultimately Mr. Galton joined the outside sales staff and represented the company in the West End.

COMMERCIAL AND INDUSTRIAL NEWS

Canadian Lamp Litigation. New Blackburn Electricity Offices. Scottish Contractors' Dinner. Aluminium Consumption in 1938. Portable Air-raid Shelters. Brewery Air-conditioning

Lamp Patent in Canada

ELECTRIC light bulbs exported by the Fuso Electric Works of Tokyo, Japan, and distributed in certain parts of Canada, infringe the Pipkin patent on an inside frosted bulb held by the Canadian General Electric Co., Ltd., according to a judgment issued by Mr. Justice Maclean, president of the Exchequer Court of Canada, at Ottawa. The judge also found that the Pipkin patent was an invention and had not been anticipated. Costs were awarded to the plaintiffs. The action was commenced in June, 1936, and the hearing took place at Ottawa in January, 1938, when judgment was reserved. The Japanese company had contended that the Pipkin patent was invalid because it disclosed no invention; that it was not new and had been anticipated by others; and that the claims included more than any invention Pipkin had made. They also asked for a declaration that no valid claim in the General Electric patent had been infringed by lamps sold in Canada under the trade mark "Fuso." Mr. Justice Maclean held against them on all four points. The corresponding patent had previously been upheld in two appeal court decisions in the United States. A number of other actions have been commenced by the Canadian General Electric for the infringement of the Pipkin patent by other imported lamps, proceedings having been stayed pending the issuing of Mr. Justice Maclean's judgment in the Japanese action.

A Benjamin planned lighting system at the new printing works of W. N. Sharpe, Ltd.

New Blackburn Electricity Offices

There are few centres in the North of England which possess finer headquarters for their electricity undertaking than that which has just been completed at Blackburn. Appropriately enough, the new building is situated on the site in Jubilee Street, where the original offices of the Department stood, and Sir Cyril Hurcomb, chairman of the Electricity Commission, will perform the opening ceremony on January 31st. The exterior of this fine building has a remarkably good frontage in the heart of the borough, and an old building near the railway station is to be demolished, so giving the new headquarters an even better approach. The scheme is a tribute to the foresight and initiative of Mr. R. H. Harral, the chief engineer and manager. All the various departments are well housed with the latest equipment, and so far as one can judge, these premises will serve the purpose of the undertaking for a number of years to come. The cost of the new building is over £20,000. In the basement there are an electrode boiler chamber for general heating, strong room and other quarters. On the ground floor there are an attractive entrance hall lined with decorative walnut, inquiry office, accounts and general office, records department, timekeeper's quarters, &c. On the first floor are situated the private office of the engineer and manager, a board room, and other offices, while on the top storey are a well-appointed drawing office, excellently lighted, and the mains offices. The office staff was transferred to the Town Hall in 1916-17, and the continued progress of the Department has made the new headquarters imperative.

Lighting a Printing Works

Evenly diffused lighting and absence of harsh shadows are features of an electrical installation recently completed at a new printing works built by W. N. Sharpe, Ltd., at Bradford, for high-class printing of Christmas cards, &c. The Benjamin planned lighting system employed comprises 300-W lamps in "Saaflux Glassteel" diffusers which provide an average illumination of 20 ft.-candles.

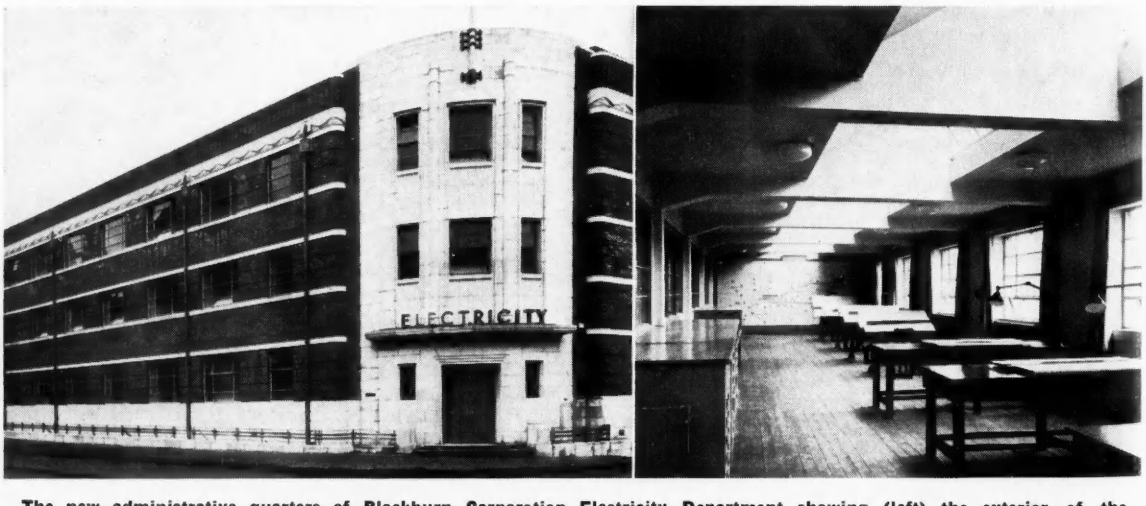
E.L.M.A. Conference for Architects

A series of conferences open only to architects has been arranged by a joint committee of the architectural profession and the E.L.M.A. Lighting Service Bureau for each Wednesday next month.

At the first, which will be held on February 1st, Mr. R. O. Sutherland will discuss the relation between natural and artificial illumination in architecture. The principal speakers at the following conferences will be Mr. L. J. Davis ("Research and Developments in Electric Light Services"), Mr. G. H. Wilson ("The Scientific and practical Design of Lighting Equipment") and Mr. H. Lingard ("Illumination Problems in Domestic Architecture").

Scottish Electrical Contractors' Dinner

Speaking at the recent annual dinner of the Electrical Contractors' Association of Scotland at Edinburgh, Lord Salvesen, P.C., said that, like all great blessings, electricity had its dangers, and the law at present did not seem to provide adequate protection to the householder, especially in respect of defective installations. One of the main objects of the Association was to remedy this, and it was proposing to have legislation enacted that would make it compulsory for those who undertook the installation of electrical appliances to become registered and obtain a licence. Every one of the Dominions already had compulsory registration of electrical contractors, and the results were very remarkable. For example, whereas in Great Britain it was estimated that there were 3,800 fires per annum due to electrical appliances in some way going wrong, the total number in New Zealand was about 23 per annum. This worked out at thirteen times as many fires in



The new administrative quarters of Blackburn Corporation Electricity Department showing (left) the exterior of the premises and (right) the drawing office

Great Britain having regard to the consumption of electricity as there were in New Zealand. There was a great risk when they were dealing with a speculative builder, who was out for cheapness, of his taking the lowest estimate quite irrespective of the fact that the man to whom he entrusted work had not adequate knowledge. The president, Major Robert Kilpatrick, in reply, said that the Association was doing everything in its power to promote its main objects, among which were excellence in electrical work and honourable practice in the conduct of business. Other speakers were Mr. H. M. Speirs, vice-president of the Association; Mr. Walter Riggs, president of the E.C.A.; Mr. Edwin Seddon, city electrical engineer of Edinburgh; and Mr. W. F. Moir.

F.B.I. and British Commercial Policy

The Federation of British Industries has prepared a memorandum replying to a statement made by the Board of Trade upon suggestions for improving our trade position made by the F.B.I. last year. In the course of this a number of points in the Board's statement are criticised. The necessity for increasing exports to enable us to meet our commitments and counteract reduced receipts from overseas investments is stressed. It is stated that rearmament has not affected the exporting industries so much as might be thought; some of them are substantially underemployed. The withdrawal of most-favoured-nation treatment is recommended in the case of countries which subsidise exports or are unwilling to meet the reasonable requirements of this country with regard to the treatment of United Kingdom goods, and the exercise of discriminatory tariffs. The best solution of the problem of uneconomic competition is held to be the conclusion of arrangements between industries in the competing countries and in this connection the importance of the appropriate organisation of United Kingdom exporting industries is stressed. The new Export Credits Bill is welcomed and the Federation suggests that financial facilities should be granted to countries which are willing to increase their purchases of British goods.

Radio Exhibition as Usual

The Radio Manufacturers' Association has rejected a proposal to substitute a £50,000 co-operative advertising campaign for the usual Radio Exhibition at Olympia.

Royal Visit to the B.I.F.

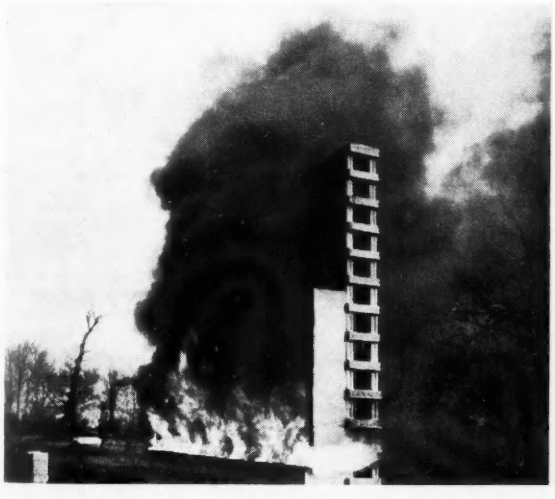
The King and Queen are to visit the Birmingham Section of the British Industries Fair on March 1st.

A Free Display Turntable

Until the end of February Orel-Micro Electric, Ltd., 39, Berners St., W.1, is supplying a battery operated display turntable free to every dealer ordering three assorted "Hanley" shavers and a battery operated electric clock.

Fire-proof Wall Demonstration

We recently witnessed a demonstration at the Slades Green works of G. R. Speaker & Co., Ltd., at which a wall, built approximately to the type used for separating transformers and switchgears, &c., was subjected to oil fire. The foundation



The "Eonit" wall during the fire test [*Elec. Rev. photo.*

consisted of a slab of pumice concrete and on this was built a cavity wall of two 4-in. external leaves of "Eonit" pumice partition blocks, joined together with 18 in. by 9 in. by 4 in. blocks. The overall width was 18 in., cavity 10 in., length 20 ft. and height 15 ft. The blocks were bedded in pumice fines and cement 6:1, with joints about ⅜ in. thick, the wall surfaces being left unplastered. In front of this a trough 18 in. wide and 18 in. deep was built along the whole length of the wall, the inside of which was slurried over with pumice fines and cement to close the interstices of the blocks and to prevent escape of oil. The test commenced at 10.30 a.m., when a hose was directed on to the wall for about 10 min. The trough was then drained and filled with 40 gall. of transformer oil, with a flash point of 165 deg. C. Into this was tipped a can of petrol, and the mixture was ignited. This burned from 10.43 until 11.5, when a hose was played on to the wall until the fire was extinguished. No disintegration had taken place, and the only damage that could be seen was that the joints in the first two or three courses showed a fine hair crack. The stability of the wall was unimpaired and from a general investigation it appeared to be in as sound a condition then as it was before the fire. When the fire had been burning for about 10 min. the back of the wall was not even warm. Among those present were Mr. Nicholls, for the C.E.B., and Mr. Cruttwell, for Merz & McLellan.

Lighting in the "Durban Castle"

A feature of the Union-Castle Line's new motor vessel, the *Durban Castle* (17,388 tons), is the good use that has been made in the principal public rooms of indirect and cornice

Effective use of concealed lighting in the tourist dining saloon of the "Durban Castle"

lighting, using "Linolite" architectural and cornice fittings with Crompton opalised and clear striplights. In the first-class dining saloon this concealed lighting has been used in conjunction with large side mirrors to give a very spacious effect, while in the smoking room concealed lighting shows to best advantage a decorative picture of Durban. Altogether over 2,500 lamps (mostly Crompton) have been installed. Electricity is provided by four 450-kW Diesel generator sets of the Harland-B. & W. two-cycle, single-acting, poppet valve type, each having six cylinders.

Record Aluminium Consumption

According to an estimate issued by the Aluminium Information Bureau the consumption of aluminium in the United Kingdom in 1938 reached a new record of approximately 65,000 long tons, about 35 per cent. more than in 1937 and 88 per cent. more than in 1936. Home production of aluminium is indicated by the fact that the imports of bauxite in 1938, at 248,930 tons, were 13½ per cent. above the imports in 1937. About 80 per cent. of Britain's supplies of aluminium in 1938 were imported as metal, the bulk of the remainder being produced from imported bauxite. Out of the 46,254 tons of aluminium imported in ingots, blocks, slabs, &c., in 1938 Canada supplied 30,414 tons, Switzerland 9,546 tons and Norway 5,348 tons. Imports of aluminium sheets, circles, shapes, &c., increased from 3,643 tons in 1937 to 4,444 tons in 1938, while imports of foil and other manufactures decreased from 1,733 tons to 1,304 tons. The total imports of aluminium in all forms were 40 per cent. higher in 1938 than in 1937. Exports of aluminium from the United Kingdom tend to decrease, the total exports for 1938 being 6,326 tons against 10,191 tons in 1937 and 6,780 tons in 1936.

Electrical Appliance Census in Holland

A partial census of 18,000 households in Holland undertaken by the Dutch electrical industry gives the total number of appliances in use as 68,374. The most popular appliance was the vacuum cleaner, of which 15,146 were counted, followed by electric irons (15,103), radiators (4,936), electric clocks (972), electric ranges (430), washing machines (305) and refrigerators (246). As a result of the census it is expected that a campaign will shortly be initiated in an effort to increase the use of electric cookers.

Protection Against Skin Complaints

A striking poster has just been issued by Sternol, Ltd., for fixing to works notice boards so that workmen may be encouraged to make full use of the "Sternocleanse" provided by the management as a means of protection against dermatitis and other skin troubles.

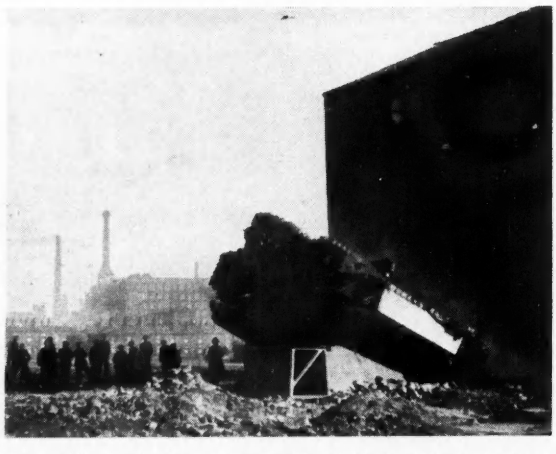
Chinese Engineering Apprentices

Six young Chinese engineers arrived in London last week to receive practical training in engineering works under the scheme of scholarships operated by the Federation of British

Industries. They form a part of a group of twenty-one apprentices selected from a hundred and twenty applicants on the basis of technical qualifications, personality, knowledge of English and general fitness. They are all graduates in engineering of approved universities in China or Hong Kong. The scheme, which has now been in operation for five years and under which fifty-seven scholarships have already been awarded, is intended, apart from fitting these apprentices for responsible engineering positions in China, to develop trade and cultural relations between China and the United Kingdom.

Portable Air-raid Shelters

A series of very stringent tests has recently been carried out by Switchgear & Cowans, Ltd., to prove that the S. & C. portable sectional air-raid shelters are capable of providing



Testing the protection given by the S. & C. portable air-raid shelter against falling masonry

protection not only from flying splinters but also from the more general and equally dangerous risk of falling masonry. Local demolitions provided the site for the tests, several of which were made on the same shelters. House walls, complete with heavy chimney work, were scientifically "dropped" direct on to the shelters without damaging them. It is claimed that in actual service few masonry falls could equal in concentrated severity those made in these tests, and it speaks well for the design and construction of the shelters that they survived such drastic treatment.

Information for Employees

The Midland Electric Manufacturing Co., Ltd., has sent us a copy of a booklet which it has prepared for distribution to its employees. This contains a brief history of the company (founded in 1908) and is illustrated by views of the works. Next the terms of employment are stated, mention being made of certain offences which may lead to dismissal. A section on wages and working conditions gives particulars of the rates of payment and hours. With regard to the latter, it is the policy of the company to reduce wherever possible the normal working week from 5½ days to five without reduction in pay. Among other matters it is mentioned that, subject to time-keeping and length of service, all employees receive a fortnight's paid holiday a year. The latter half of the booklet describes welfare and social activities at the works.

Calendars

The calendar of the Thames Wire & Cable Co., Ltd., has different coloured sheets for each month.

The monthly sheets of the calendar of Nalder Bros. and Thompson, Ltd., are printed in easily legible red lettering.

William Urquhart has sent us a calendar with monthly sheets mounted on a card illustrating some of the company's machine tools. At the back there is a calendar for the whole year and general postal information.

Anglo-German Trade Relations

Arrangements are being considered for an official meeting between the Federation of British Industries and the German Reichsgruppe Industrie to discuss Anglo-German trade relations and the question of competition between the two countries.

Air-conditioning in a Brewery

Special arrangements for air-conditioning are now being completed at the new "Guinness" bottling department at Taylor Walker & Co.'s brewery at Limehouse, E. When the atmospheric temperature is below the desired 50 to 60 deg. F. "Satchwell" thermostats automatically control (by means of magnetic valves) the hot water supply to a radiator system incorporated inside trunks, into which the air is drawn by means of a "Sirocco" fan belt driven by a 7½-HP, 1,400 RPM Crompton Parkinson motor. If the temperature outside the building is below 50 deg. F. further thermostats close electrically operated window shutters, thereby cutting off the air supply from outside and providing for recirculation of the air inside. By the time the warm weather comes a Lightfoot ammonia compressor will have been installed for cooling the air. This too will be thermostatically controlled. E.A.C. shunt regulator controls are used for both the fan and compressor motors. The trunking system, consisting of 2 ft. diameter cylindrical galvanised iron tubing, is suspended from the ceiling with outlets at every few feet. The electrical contractors are S. Rogers & Co., Ltd. Another interesting innovation at the brewery is the provision of a small thermostatically controlled electric booster heater for the cask drying plant. Owing to the variations in the steam pressure it had been found difficult to produce and maintain the temperature of air required. Accordingly a supplementary electric heater loaded at 5 kW was specially designed by Bastian & Allen, Ltd., for the purpose.

Dutch Lamp and Radio Exports

The Dutch Central Statistical Bureau reports that the value of the exports of wireless manufactures from Holland in 1938 amounted in value to 44,836,000 fl., as compared with 52,640,000 fl. in the previous year. Tungsten filament lamp exports were valued last year at 6,336,000 fl., 1,039,000 fl. less than in 1937.

Famous Landmark to Go

W. T. Henley's Telegraph Works Co., Ltd., is about to remove a famous landmark from their Gravesend works site—the second of the two towers which were part of Rosherville Gardens in the heyday of their popularity in the late nineteenth century. The tower, which is to be demolished because it is unsafe, was erected in 1870 when the London Road entrance to Rosherville Gardens was constructed. Henley's have taken over the whole of the Rosherville Gardens site for cable factory extensions.

A National Wireless Register

Our contemporary, *Wireless World*, with the approval and assistance of the Wireless Telegraphy Board of the Admiralty, is asking its readers to enter their names in a National Wireless Register designed to form a record of men available with a knowledge of radio technique and operation. A form is included in the issue of January 26th, in which relevant particulars can be entered and which, when completed, is to be sent to the Board.

Key Industry Duty

The Board of Trade has received an application under Section 5 (5) of the Finance Act, 1936, for a licence to import free of duty one neon discharge tube capable of operating with a current of approximately one micro-ampere, for demonstrating the negative layers of Holst and Oosterhuis, and one neon discharge tube with variable electrode separation for demonstrating the development of the positive column. Any representations that similar apparatus is made, or is likely to be made within a reasonable time, in the United Kingdom or elsewhere in the Dominions, should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, London, S.W.1, within one month from January 23rd, with details of such similar apparatus and quoting the reference I.M.5143/38.

Aluminium in Structural Work

An important development in the production of aluminium alloy extruded sections which is of particular interest to architects, builders and engineers, is announced by the Northern Aluminium Co., Ltd. Limitations of size of extruded sections have involved in many cases the building up of composite parts, but new plant installed at the company's Banbury works for the production of larger sections than have hitherto been available in this country has eliminated the need for such additional work. A one-piece extrusion means a greater strength-weight ratio and, equally important, an appreciable saving in labour costs.

Trade Announcements

W. T. Henley's Telegraph Works Co., Ltd., have recently acquired another large portion of the old Southern Railway Hotel in Holborn Viaduct. The sales/export department, sales/wiring systems, mailing and other departments have been transferred there, while other head office departments, including the Holborn Construction Co., have occupied the offices vacated.

The Wego Condenser Co., Ltd., has appointed Mr. M. R. Gibson, 76-86, Clydeferry Street, Glasgow, C.2 (telephone: Central 2234) as its representative for the whole of Scotland.

In addition to manufacturing paper-insulated cables, the Britannic Electric Cable & Construction Co., Ltd., is now supplying cab-tyre-sheathed trailing cables, all types of armoured and unarmoured rubber-insulated cables, and "Inverite" insulated and other types of rubber-insulated cables for lighting and power.

The Cardiff branch of Siemens Electric Lamps & Supplies, Ltd., has been removed from Wood Street to Siemens House, Hill's Street, Cardiff, where more commodious premises have been taken which include office and stores accommodation. The telephone number is Cardiff 7128-9, and the telegraphic address, "Siemens, Cardiff."

E.A.W. Examination for Demonstrators

The eleventh examination in electrical housecraft for demonstrators and saleswomen, organised by the Electrical Association for Women, was held on December 16th in London, Newcastle-on-Tyne, Birmingham, Glasgow, Manchester, Bristol,

Leeds, Lincoln, Devonport, Portsmouth, Cardiff, Norwich and Clacton-on-Sea. Of the fifty-seven candidates who entered for the examination, forty-six were successful, eight obtaining distinction. There are now 638 holders of the certificate.

Bermuda Tariff Reduction

Among the recent alterations in Bermuda customs duties is a reduction from 25 to 20 per cent. *ad valorem* under the general tariff upon the following goods: Appliances and apparatus fitted for operation by electricity, including radios and radio parts; bulbs, lamps and radio valves or tubes, fitted for or capable of operation by electricity; and fittings or fixtures used in wiring for electrical supply. The British preferential duty remains at 10 per cent.

Employment in December

Employment in the engineering industry showed an improvement between November 14th and December 12th in most of the principal sections of the industry, and continued good in electrical engineering. According to the *Ministry of Labour Gazette* the number of unemployed in the engineering industry was 86,715, a decrease of 5,849 as compared with the previous month, the percentage falling from 7.4 to 6.9 (5.4 per cent. in December, 1937). In the electrical engineering industry there were 5,753 out of work, a decrease of 0.4 per cent. to 4.9 per cent. as compared with the previous month and an increase of 1.6 per cent. over December, 1937. The unemployed in the electrical wiring and contracting industry totalled 4,149, showing a slight increase of 0.1 per cent. to 9.7 per cent. (9.1 in December, 1937). In the electric cable, apparatus, lamps, &c., group the total unemployed at 12,149 also showed a small increase of 0.1 per cent. as compared with the previous month, but a decrease of 0.1 per cent. as compared with the corresponding period of 1937.

Prices of Materials

Henry Gardner & Co., Ltd., report, January 25th: Copper bars (best selected), sheet and rod, no change. English pig lead, £16, 10s. decrease. Spelter, £13 11s. 3d., 7s. 6d. decrease. English block tin, £214 10s., £3 10s. decrease. Mercury, no change.

Frederick Smith & Co. report, January 25th: Electrolytic copper bars, £48 15s., 5s. decrease. Ditto, ditto, wire rods, £53 10s., 5s. decrease. Ditto, ditto, h.c. wire, 7 1/16d., 1/16d. decrease. Silicium bronze wire, 8 1/16d., 1/16d. decrease.

Edward Till & Co. report, January 25th: India-rubber, Para fine, 6 3/8d., 1/8d. decrease.

New Catalogues and Lists

Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2.—A handsomely produced brochure of 28 pages illustrating some of the more outstanding models of the latest "Metalix" range of X-ray apparatus for diagnostic purposes.

Constructors, Ltd., Nickel Works, Tyburn Road, Erdington, Birmingham.—Details of "Adjusteel" shelving.

Birmingham Electric Furnaces, Ltd., Birlec Works, Tyburn Road, Erdington, Birmingham.—A 24-page reprint of a paper by Mr. J. H. Crossley on "Electric Furnaces for Heat Treatment, Bright Annealing, Brazing and Similar Applications."

Sun Electrical Co., Ltd., 118, Charing Cross Road, London, W.C.2.—A 40-page catalogue of telephones and accessories.

Glenfield & Kennedy, Ltd., Kilmarnock.—Details of the "Recal" non-return valve for use in conditions of abnormal severity.

Hanovia, Ltd., Bath Road, Cippenham, Slough.—A new handbook on indoor sun-bathing called "Get Back in the Sun with a 'Homesun.'"

James Beresford & Sons, Ltd., Cato Street Works, Birmingham, 17.—A leaflet describing and illustrating the James Beresford light mobile fire engine.

Dorman & Smith, Ltd., Ordsal Electrical Works, Salford, Manchester, 5.—Leaflet L.131, dealing with sub-station-type gear.

Hopkinsons, Ltd., Huddersfield.—A folder describing an automatic emergency closing valve.

Bankruptcy Proceedings

J. Stubbs and **J. A. P. Boulton,** carrying on business in partnership under the style or firm of John Stubbs & Co., 39, Bootham, York, electrical engineers.—The public examination of these debtors took place at the Law Courts, Clifford Street, York, recently. In reply to questions, Mr. Stubbs said that he commenced business as an electrical engineer in October, 1927, with a capital of about £60. His partner joined him in May, 1934, and contributed £1,500. In 1935 further capital of £2,000 was introduced. In April, 1937, he was injured in a flying accident, and that prevented him from attending to the business. Certain branches which had been previously opened had to be closed, with the result that the partners had a considerable amount of stock on their hands. Arrangements which were being made to transfer the business to a limited company fell through, although a substantial amount of capital had been at first subscribed. The examination was adjourned for accounts to be supplied.

J. T. Wyer (East Coast Electrical Services), electrician and wireless dealer, 34, Hilderthorpe Road, Bridlington, Yorkshire.—At the public examination held recently at the Court House, Castle Road, Scarborough, it was reported that there were ranking liabilities of £67 and assets of £1, leaving a deficiency of £66. Debtor commenced business in May last year with borrowed capital of £200, none of which had been repaid. He said that the trade done had never been sufficient to cover his expenses. Competition had been keen, and he could not cope with it. The examination was closed.

T. J. Mathews (Universal Radio), wireless dealer, 40 Rumbridge Street, Totton, Hants, formerly carrying on business at 105, High Street, Shirley, Southampton, and 66A, St. Mary's Road, Southampton, and at 4, Bridge Street, Winchester.—The application for discharge was heard at the Court House, Castle Square, Southampton, on January 17th. It was reported that the receiving order was made in 1934. Debtor now stated that he desired his discharge to take up a directorship. The Judge granted the discharge, subject to one year's suspension.

W. L. M. Jones, radio dealer, 118, High Street, Blackwood, Monmouth.—Receiving order made January 17th on debtor's own petition.

A. W. Sadler, radio engineer and dealer, 115, Osmaston Road, Derby.—Last day for receiving proofs for dividend February 4th. Trustee, Mr. A. J. Rogers, 22, Regent Street, Park Row, Nottingham, Official Receiver.

A. H. Estall, electrical contractor, 20, Thackeray Street, Kensington, W.8.—First and final dividend of 1s. 6d. in the £, payable February 3rd at Balfour House, Finsbury Pavement, E.C.2.

F. H. Bennett, radio dealer, 52, Oaklands Road, Ilford.—Receiving order dated November 17th, 1938, discharged and order of adjudication dated November 30th annulled, a composition of 20s. in the £ with 4 per cent. interest being paid on all provable debts.

R. S. Lees (R. S. Lees & Co.), lately electrical factor, now commercial traveller, 21, Gledhow Park Road, Leeds.—Supplemental dividend of 1s. 9½d. in the £, payable at the Official Receiver's Office, 24, Bond Street, Leeds.

A. Robson ("The Anson Radio"), wireless engineer, 147, Dickinson Road, Rusholme, Manchester.—Supplemental dividend of 1s. 11d. payable at the Official Receiver's Office, Byrom Street, Manchester.

Company Liquidations

Universal Lighting Co., Ltd., High Street and Station Road, Clacton-on-Sea.—The statutory meeting of creditors was held recently at Winchester House, Old Broad Street, E.C., when it was reported that the shareholders had previously met and passed the usual resolution for the voluntary liquidation of the company, Mr. H. Rainsbury, 139, Finsbury Pavement, E.C., being nominated to act as liquidator. A statement of affairs submitted showed liabilities of £3,170, of which £2,098 was due to the trade and £1,072 to cash creditors. The assets were estimated at £1,694, but they were subject to preferential claims of £158 and £1,347, due on a debenture. The net assets, therefore, were £189, leaving a deficiency, as regarded the creditors, of £2,982. The creditors passed a resolution confirming the appointment of Mr. H. Rainsbury as liquidator. Mr. Rainsbury stated that he was carrying on the business with a view to selling it as a going concern.

Neon Signs (Preston), Ltd.—Particulars of claims by February 16th to the liquidator, Mr. R. E. Smalley, 9, Chapel Street, Preston.

Superlamp, Ltd.—Meeting February 20th at 19, Fenchurch Street, E.C.3, to receive an account of the winding-up by the liquidator, Mr. H. E. Spry.

George Skey & Co., Ltd.—Meeting February 23rd at 28, Lambeth High Street, S.E.1, to receive an account of the winding-up by the liquidator, Mr. E. B. Green.

A. Melville Sidley, Ltd.—Meeting February 28th at 14, High Street, Coventry, to receive an account of the winding-up by the liquidator, Mr. S. J. Hull.

Discharge Lamps for Display Lighting

A LECTURE on the possibilities for display lighting opened up by the introduction of electric-discharge light sources was given by Mr. R. O. Ackerley, chief of the G.E.C. illuminating engineering department, at Magnet House, London, on Wednesday. The audience consisted of display specialists, who were welcomed by Mr. J. Y. Fletcher, a director of the company. After describing the electric discharge light sources available, Mr. Ackerley demonstrated possible ways in which they might be used for display lighting. The first demonstration was a comparison between a window with plain tungsten lighting and a similar window with the "T.O.T." system. The next application demonstrated was the use of colour lamps for obtaining special background effects. Mr. Ackerley then gave a demonstration of show-window lighting by means of "Osira" fluorescent tubes, which showed up the display, draperies and soft goods, in colours remarkably close to natural daylight, while the relatively large area of light source gave a softness to the display. Having demonstrated various forms of visible electric-discharge light sources the lecturer turned his attention to invisible or "black" light, and the manner in which this system could be applied to a trade name and slogan display and its use in conjunction with normal lighting for display of goods, were illustrated.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

SUNBRITE OR SUNBRIGHT SUNRAY standard table lamps.
USALITE rubber-covered torch.
RADIARAY electro-medical elements.
ROWAN fire.
LECTALIX cable.

ELECTRICITY SUPPLY

Power Station Extensions at Cardiff and Croydon. Inverness Perseveres. The Manchester Explosions. Yorkshire Supply Area Arbitration.

Addington. — DISTRIBUTION PROPOSALS. — The County of London Co. is to carry out extensions at a cost of £5,155 to supply the Layne Well pumping station. In view of the proposed transfer of Addington to the Croydon Corporation the Electricity Committee is arranging for the company to carry out various works, costing £17,223, to facilitate the change-over.

Bedford.—INCREASED TARIFFS.—The Town Council has decided to raise electricity charges to meet a probable deficit on the year's working of the electricity undertaking. Averaged out over the various classes of consumers the increase amounts to about 6 per cent.

Bedlington.—ELECTRIC STREET LIGHTING.—The Urban District Council has accepted the offer of the North-Eastern Electric Supply Co., Ltd., for lighting the streets by electricity, including areas at present served by gas.

Birmingham.—NEW SUB-STATIONS.—The Electric Supply Committee is to have sub-stations built at Sevenstar Road, Solihull; Kents Moat Farm estate, Stechford; and at Gresham Road, Hall Green.

Brandon (Co. Durham).—NEW SUPPLY ARRANGEMENTS.—Straker & Love, Ltd., colliery owners, have announced that they are ceasing to supply the area with electricity as from February 1st and the district will afterwards be served by the North-Eastern Electric Supply Co., Ltd. The supply will be changed to AC.

Cardiff.—ROATH POWER STATION EXTENSIONS.—Originally estimated to cost £500,000, the proposed extensions scheme for the Roath power station is to be added to so that the cost will be brought up to £600,000. Of the additional £100,000 something like £75,000 will be spent on buildings. The capacity of the boilers is to be increased and, at the request of the C.E.B., provision is to be made in the present scheme for further new plant. It has been decided that Mr. E. Jones, the city electrical engineer, shall receive an unpensionable salary of £500 per annum in his capacity of consulting engineer for the extensions.

Corby.—PUBLIC LIGHTING.—Work has commenced on the installation of sodium lighting in Rockingham Road, Corby. Occupation Road and Forest Gate Road are already similarly equipped.

Croydon.—EXTENSIONS TO POWER STATION.—The Electricity Committee has prepared a scheme for extensions at the generating station at a cost of £113,000.

Cupar.—STREET LIGHTING.—The Council is considering a proposal to introduce electric street lighting in two East Fife villages, Dairsie and Strathmiglo.

Forden.—EXTENSION.—The West Midlands Joint Electricity Authority proposes to extend the mains to Church Stoke.

Gateshead.—SODIUM LIGHTING.—The Town Council is to improve the lighting of the main road between Bensham Road and East Park Road with sodium vapour lamps at a cost of £780.

Guildford.—SUB-STATION.—The Mid-Southern Utility Co. is to erect a sub-station in connection with the supply to sixty houses being erected by the Rural District Council at College Road, Ash.

Hove.—CHANGE-OVER.—The Electricity Committee has recommended that the electricity supply to consumers in Eaton Villas, Goldstone Villas and Denmark Villas should be changed from DC to AC. The estimated cost is £2,635.

FEEDER CABLE.—A three-core 0.3 sq. in. feeder cable is to be laid from the Old Shoreham Road sub-station to a feeder pillar. The estimated cost is £880.

Inverness.—CONSULTING ENGINEER TO ADVISE COUNCIL.—At the last meeting of the Town Council reference was made to a letter from the Secretary of State for Scotland with regard to the installation of additional plant at the burgh generating station. The Secretary of State wrote that he had taken the matter up with the Minister of Transport, who had explained that there was no appeal to himself from the decisions of the Electricity Commissioners on the application for their consent to an installation of this kind, which are thus final, but on the other hand the Commissioners could not refuse consent to an application without first having a local inquiry. The Secretary of State added that the Council's best course would be to supply the information for which the Commissioners had asked, and to request formal consideration of its application. After consideration the Council agreed that Mr. Donkin, consulting engineer, should be instructed to report generally with regard to the Council's application to the Electricity Commissioners for the installation of additional plant, taking all relevant factors into account.

Isle of Man.—BULK SUPPLY CHARGES.—Differences have arisen between the Isle of Man Electricity Board and the Douglas Town Council regarding the scale on which the Council fixes its charges for electricity supplied to the Board in bulk. The Town Council is now asking the Board if it is prepared to submit to an independent engineer to be nominated by Sir Cyril Hurcomb, chairman of the Electricity Commissioners, the question as to whether the purchase clauses contained in the Isle of Man Electric Light and Power Act, 1932, are, as the Board maintains, unsatisfactory.

London.—ISLINGTON.—The Electricity Committee has approved an agreement with the L.C.C. for the supply of electricity to the Tufnell Park housing estate.

FLOODLIGHTING PLAYGROUNDS.—The National Fitness Council announces a grant of £1,250 to the London County Council towards the cost of installing floodlighting at seven of the Council's playgrounds. The grant is conditional upon the balance of the cost being met by the Council. This is one of the most important floodlighting schemes undertaken by any local authority and it is hoped that the provision of organised games and physical fitness classes in London will be considerably facilitated.

SWITCHGEAR AT KINGSTON.—At the quarterly meeting of the London and Home Counties J.E.A. on Wednesday the Technical Committee reported that as a result of the fire at the Kingston generating station it was considered undesirable to reinstate the replacement switchgear in the original position in the engine room and the question of erecting a new and entirely distinct switch-house was being discussed with the Kingston Corporation and the C.E.B. In the meantime, in order to provide some switching arrangements on the feeders which had been temporarily connected up direct on to the C.E.B. transformers, the Committee had approved arrangements made with the General Electric Co., Ltd., for the loan of a fourteen-panel switchboard to be accommodated in a temporary building to be erected adjacent to the site of the new switch-house.

Lossiemouth (Morayshire).—PLANT OVERLOADED.—Mr. Trail, electrical engineer, reported to the Town Council at its last meeting that on two occasions recently the generating plant had been overloaded. He suggested that the Electricity Commissioners should be made aware of this so that additional plant might be obtained.

Manchester.—EXPLOSIONS IN ELECTRICITY MANHOLES.—It was reported to the Electricity Committee last week that the supply of electricity to 1,369 consumers was interrupted in consequence of the explosions which occurred at 6 a.m. on January 16th. The supply to a large number of these was quickly restored by bringing into use alternative feeding arrangements. Others were reconnected at frequent intervals during the day by carrying out emergency repairs and by the use of temporary cables. When darkness came not many were without light, and these received a supply later in the evening. The Committee passed a resolution expressing appreciation of the fine work accomplished by the engineers and men of the mains section. Following the explosions last week a number of men were remanded in custody on a charge of being unlawfully in possession of gelignite and other materials.

ANNUAL ESTIMATES.—The Committee also considered the annual estimates for the year ending March, 1940. Sales of electricity are estimated at 3 per cent. over the present expectation for the current year. The income, however, is estimated to be £6,300 less than the estimate a year ago. Expenditure is estimated at £3,465 more than for the current year, and the surplus of income over expenditure (before taxation) is expected to amount to £34,910 (against £44,675). For coal, which continues to show an increased price per ton, the expenditure included in the estimate for Manchester's requirements is £408,500 (excluding coal required for the electricity exported to the Central Electricity Board).

Newborough (Northants).—RURAL SUPPLIES.—Negotiations are in progress between representatives of the villagers and the Spalding Urban District Council regarding the provision of a supply of electricity to the parishes of Newborough and Borough Fen.

T.V.A. Expects a Profit

ACCORDING to the *Electrical World* the Tennessee Valley Authority reports that it is well on the way to disposing of all the power available from its navigation and flood control projects without injury to actual existing investments in privately-owned utilities. At the end of June last the Authority was carrying a deficit of $1,155,000 but it now claims to be on a paying basis and expects to show a net profit of $300,000 for the year ending next June. For the following year a net profit of $1,000,000 is anticipated. The total sales for the current financial year are expected to total $5,000,000 and for 1939-40 $6,500,000.

The capacity of the T.V.A. system is now 420,000 kW. Sixty-one municipal and co-operative agencies are now customers of the Authority. During 1938 about 1,800 miles of rural lines were placed in service bringing up the total to 4,693 miles. The average annual consumption per head of the population served was 1,270 kWh which was said to be 58 per cent. above the national average. Private dealers reported sales of appliances valued at $1,612,000, an average of $51 per customer.

Portland.—SUPPLY TO NAVAL BASE.—Electricity is to be supplied to H.M. Naval Base for water heating and cooking at the hospital at 1d. per kWh. The demand will be approximately 50 kW and the estimated annual consumption 45,000 kWh.

Scarborough.—REVISED CHARGES.—The main effect of the recent modification in tariffs has been the withdrawal of part of certain reductions which were made in 1936. Higher costs of production arising from increases in the price of coal and from other circumstances made it no longer possible to maintain the whole of these reductions. Mr. W. K. Fleming, the borough electrical engineer, states that the principal alterations are: Domestic all-in tariff.—The fixed quarterly charge is increased from 9s. to 10s. 6d. per quarter for houses of 800 sq. ft., and in similar proportion for houses up to the limit of the scale, 12,000 sq. ft. The "unit" charge remains at ½d. for consumers with electric cookers or water-heaters, but in other cases it will now be ¾d. Business and power all-in tariffs.—The first 1,000 kWh per quarter will be charged at ¾d. per kWh and all in excess at ½d., the latter figure being the previous rate for all electricity used. Domestic two-rate tariff.—Domestic consumers on ordinary flat rates for lighting and heating will be charged through one meter in future instead of two. After a certain quantity at 6d. per kWh the remainder will be charged at 1½d. per kWh. Restricted tariff.—The unrestricted flat rate tariff of ½d. per kWh for water heating previously in force has been extended to include space heating and electric vehicle battery charging, subject now to a minimum consumption of 1,000 kWh per annum and to restricted hours of use at peak load periods.

Southampton.—CENTRAL LIGHTING CONTROL.—A scheme for the control of street lighting in AC areas from a master time switch installed at the generating station is under consideration. It was stated at a recent meeting of the Council that the cost would be £23,301, but the number of lighting attendants would be substantially reduced.

Southend-on-Sea.—VALUE OF ILLUMINATIONS.—At last week's meeting of the Town Council the Joint Illuminations Committee recommended that a display costing £5,000, with £400 for overhaul of existing apparatus, should be provided this year. It was felt that the discontinuance of the illuminations would adversely affect the prosperity of the town. Representations in favour of illuminations had been received from the Seasonal Traders' Association and against them from the General Council of Ratepayers. The Council deferred its decision on the proposal in order that certain ratepayers' organisations might put their views before the Committee.

Stockton-on-Tees.—SUB-STATION.—The Town Council is to erect a sub-station in Billingham Road at a cost of £2,325, another in Albany Road costing £2,480 and one at Newham Grange.

Trowbridge.—ELECTRICITY FOR PUMPING.—The Trowbridge, Melksham and District Water Board has decided to convert the plant at the pumping station to electric drive at a cost of nearly £1,000.

West Hartlepool.—SUB-STATIONS.—The Town Council is to erect sub-stations in Southbrooke Avenue and Dyke House and extend the Brenda Road sub-station.

LOCAL TRADERS TO TENDER FOR ASSISTED WIRING.—The Town Council has agreed to allow electrical traders in the town to tender for the supply of assisted wiring materials required by the undertaking. A suggestion was made previously that the Electricity Department should purchase and supply its own requirements.

Weymouth.—IMPROVING THE SUPPLY AT WEST LULWORTH.—The electrical engineer recently reported that to maintain the normal voltage at West Lulworth it would be necessary to extend the high-voltage mains and provide an additional transformer at a cost of £1,053. Application is being made to the Electricity Commissioners for their approval of the scheme.

Whitby.—SUPPLY AT STAITHES.—The Rural District Council has approved plans by the North-Eastern Electric Supply Co., Ltd., for an extension of the supply to the housing estate at Staithes.

Yorkshire.—BULK SUPPLY ARBITRATION.—It is reported that arbitration between the Yorkshire Electric Power Co., the Electrical Distribution of Yorkshire, Ltd., and the Rotherham Corporation regarding the area of the supply of electricity taken over by the Corporation in the Whiston district is shortly to come up for hearing.

Overseas

Iceland.—NEW POWER PLANT.—Work has been started on a new hydro-electric power plant at Laxa to supply the town of Akureyri, about 60 miles away, *via* a 30 kVA transmission line. It is expected that most of the work on the plant and the line will be completed next summer.

New Zealand.—ASSISTANCE IN PURCHASE OF COOKERS.—To induce consumers to buy electric cookers the Christchurch Electricity Department offers a 20 per cent. discount off the retail price, five-year terms without interest, and includes wiring in the reduced cost. The average cost of the concessions has worked out at £4 14s. 8d., which is close to the original estimate on which the scheme was based, namely, that it would be sound business to spend one year's revenue to secure such an income permanently. Electrical traders have no complaint, because the Council enables them to offer this discount and the wiring concession on its behalf. By the end of March last 5,030 cookers had been sold under these terms, 25 per cent. of the sales being for cash in spite of the offer of interest-free deferred payments.

INCREASED CONSUMPTION.—Development was rapid in Christchurch during 1937-38. In his report for the period Mr. E. Hitchcock, the general manager, shows that the increase of 10.5 million kWh sold (15 per cent.) to a total of 80.7 million kWh was the largest annual increase and also the proportionate advance was the highest for eight years.

PROGRESS AT HUTT VALLEY.—In the area of the Hutt Valley Electric Power Board 1937-38 also brought an exceptional increase in sales of electricity. The Board, of which Mr. E. F. Hollands is general manager and engineer, supplies an area with a population of 48,200, and at the end of March last there were 13,488 consumers, indicating that the majority of premises in the area are connected to the mains. Electricity sold amounted to 31.2 million kWh, an increase of 6.4 million kWh (26 per cent.), the sales per consumer rising from 2,283 to 2,643 kWh and the annual load factor from 56 to 64 per cent. At the end of March 2,531 cookers and 2,412 water heaters were connected.

Uruguay.—HYDRO-ELECTRIC POWER STATION.—According to *E.T.Z.*, good progress is being made with the construction of the Rincon del Bonete hydro-electric power station on the River Negro, about 150 miles to the north of Montevideo, Uruguay. A huge lake for the storage of the water is being formed by the construction of a dam 98 ft. high and 1,284 yd. in width. The generating plant will comprise four Kaplan turbines, capable of working under heads ranging between 55 and 105 ft., coupled to 32,000 kVA alternators. The station will be connected to the steam-operated plants in Montevideo by two 170-kV power transmission lines, each having a transmitting capacity of 58,000 kVA.

TRACTION

France.—NEW ELECTRIC LOCOMOTIVES FOR PARIS-BORDEAUX LINE.—In view of the further electrification of the P.O.-Midi railway the company has ordered sixteen new locomotives, to be used on the Paris-Bordeaux line, states *Reuter's Trade Service* from Paris. These locomotives are of 4,000 HP and each weighs 135 tons, including an adhesion weight of 80 tons. They are already being delivered to the south-west region, and the first tests have just taken place on the Paris-Brive line in both directions at commercial speeds of from 60 to 70 m.p.h. The tests will be continued on the Les Aubrais-Saint Pierre des Corps line in both directions with a 300-ton train at speeds up to 94 m.p.h.

A novel electric bus stop signal used by the Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board **(see page 117)**

Halifax.—LAST TRAM ROUTE TO BE CLOSED.—Last week the Transport Committee decided to close the only remaining tram route—to Ovenden—on February 14th. The tramways at Halifax started in 1898, but in the last twelve years there has been a gradual change to motor-buses.

Italy.—NEW ELECTRIC TRAINS.—During 1938 there were six streamlined electric trains in service on the Italian State Railways. Towards the end of the year two more of these were delivered for service on the Rome-Leghorn route, and another is being sent to the next New York International Exhibition. Externally, these new streamlined express electric trains are practically identical with those already delivered and consist of three articulated cars mounted on four bogies. The total length of each train is 62,500 m., an there are 100 seats against ninety-four seats in the earlier cars. The six motors have a total of 1,200 HP at 3,000 V. The chief alterations are in the distribution of the various rooms in the interior of the trains. While in the first type there was a single air-conditioning plant for the whole train, in the new trains there are independent air-conditioning sets in each car. The lighting of the trains has been improved by the adoption of indirect illumination. Twenty-two Fiat-built electric railcars have

also been put into service recently. These vehicles are of all-metal construction. Each car is 26 m. long and, unloaded, weighs 37 tons. The electrical equipment includes four electric motors aggregating approximately 400 HP, the maximum speed being 84 m.p.h. A further twenty-three railcars of this type are under construction.

United States.—STEAM-ELECTRIC LOCOMOTIVE.—A 5,000-HP locomotive with its own complete turbo-generating unit has recently been completed at the works of the American General Electric Company for the Union Pacific Railroad. According to the official organ of the American I.E.E., this locomotive has been under construction for nearly two years and is intended to haul passenger trains consisting of as many as twelve cars between Chicago and the Pacific Coast over 2.2 per cent. gradients. It will be capable of speeds up to 125 m.p.h. and continuous runs of from 500 to 700 miles. The locomotive is housed in two cabs, each containing a complete 2,500-HP geared turbo-generator set, a high-pressure steam boiler, a turbine-driven auxiliary set and a finned-tube condenser cooled by turbo-driven fans. A low grade of oil, known as "bunker oil," is used for fuel. Steam pressure and temperature are respectively 1,500 lb. per sq. in. and 920 deg. F. Complete automatic control is provided for boiler, auxiliaries and power units. Twelve axle-hung geared motors drive the locomotive, six being supplied from each generating unit. The speed is controlled by varying the field current of the main generators, and electric braking is employed.

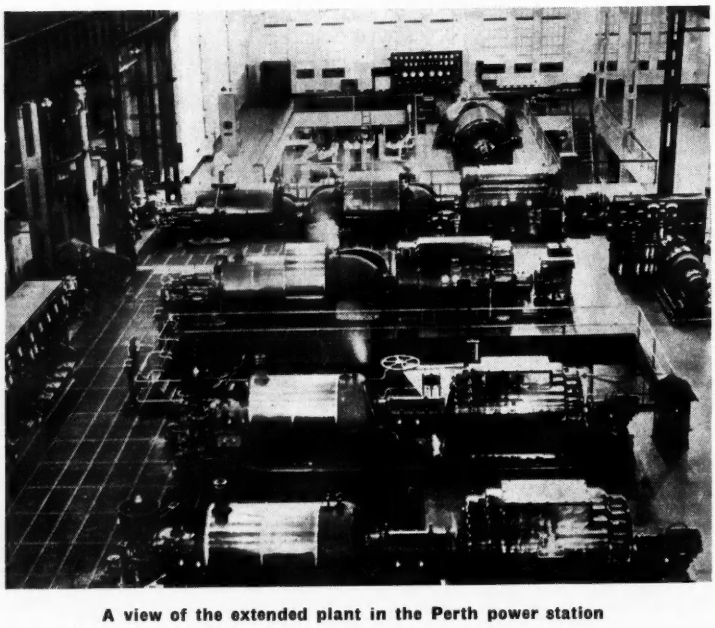
New Generating Plant at Perth, W.A.

25,000-kW turbo-alternator and steam plant

AN extension of the East Perth power station, which was constructed in 1913 for the Western Australian Government, was inaugurated last Friday, increasing its capacity from 32,000 to 57,000 kW. The area of supply, extending over 300 sq. miles, is served by a 20-kV overhead system, using Jarrah wood poles, sectionalised at about every five miles, at which points sub-stations have usually been constructed. The city of Perth, the Government tramways and the outer suburbs are supplied by a 6-kV cable system.

The new part of the building is a steel-framed structure with reinforced concrete walls, floors and flat roof, the foundations resting on 710 piles driven 30 ft. at a loading of 20 tons per pile.

The boiler plant consists of three "Lopulco" tri-drum bent-tube boilers designed for steam conditions of 625 lb. per sq. in. and 850 deg. F., compared with the 210 lb. and 600 deg. in station A. Each boiler has a heating surface of 11,100 sq. ft. and is capable of evaporating 100,000 to 135,000 lb. per hr. Their furnaces are water-cooled, with fin-tube walls. Fitted to the front wall of each furnace are four "Lopulco R" burners for the combustion of Collie coal with a calorific value of about 8,750 BThU per lb., which is pulverised in Lopulco mills of which there are two per boiler.



A view of the extended plant in the Perth power station

The steam temperature is maintained within ± 15 deg. F. for duties between 75,000 and 135,000 lb. per hr. by means of a "M.L.S." superheater having external automatic control and a heating surface of 5,000 sq. ft. The 48-tube economisers, are of the "Heenan" twin-tube type and have a heating surface of 2,340 sq. ft. each. An "Usco" plate-type air heater of 22,837 sq. ft. surface is fitted to each boiler.

Lodge-Cottrell electrostatic precipitators, designed for dust extraction of 95 per cent. when passing 75,000 cu. ft. per min. are installed on the roof of the boilerhouse before the induced draught fans (one per boiler). Each fan is of the single-inlet type operating at a maximum speed of 565 RPM. For supplying air to the furnaces, two similar fans per boiler are installed.

A self-supporting copper-bearing-steel stack, 23 ft. 3 in. inside diameter, rises to a height of 110 ft. above the boilerhouse roof. Soot blowers are fitted to boiler furnaces and economiser. Steam, feed and blow down piping is by Aitons, high-pressure lengths having Corwell welded joints. All high-pressure valves are by Hopkinsons, Ltd.

Of the three feed pumps, two are driven by drip-proof fan-cooled 500-HP electric motors and one is steam driven. Each has a capacity of 300,000 lb. per hour, against a total pressure of 825 lb. per sq. in. The speed of the electric pumps is controlled by Vulcan-Sinclair couplings within a range of 2,300 to 1,980 RPM.

Automatically controlled reducing valves and a de-superheater capable of passing up to 250,000 lb. of steam per hour, reduce the pressure from 625 lb. per. sq. in. to 225 lb. per sq. in. and the temperature from 850 deg. F. to 700 deg. F. for use in the "A" station.

The new two-cylinder tandem 2,400-RPM reaction turbine operates with an initial steam pressure of 600 lb. per sq. in. 800 deg. F., and expands the steam down to 50 lb. abs. before transferring it to the single-ended low pressure cylinder which exhausts to a 33,000-sq. ft. welded-steel condenser fitted with an air ejector and duplicate extraction pumps, the vacuum being 28.28 in Hg. (Bar 30) at most economical load (20,000 kW). Three-stage feed heating gives a final condensate temperature of 324 deg. F. at 20,000 kW.

The m.c.r. of the alternator is 31,250 kVA at 6.3 kV and the exciter and pilot exciter are direct coupled to it. The stator is built up of electrically welded mild steel plates and bars, and is wound with Parsons stranded coreless cable, the individual wires of which are insulated and spiralled in a definite lay to minimise eddy currents. A single solid mild-steel forging is used for the rotor. Ventilation is on the multiple-inlet enclosed system, air being circulated by two motor-driven fans. The exciters and sliprings are totally enclosed and are ventilated by air from the main air circuit, which is returned to it through viscous filters.

The machine circuit breaker is of the semi-ironclad type with a rupturing capacity of 500,000 kVA. Supply to the auxiliaries at 440 V is obtained from four 1,000-kVA transformers, *via* a 24-panel Metrovick metalclad switchboard with 2,000-A air-insulated bus-bars and 1,500-A electrically operated oil circuit breakers feeding Metrovick "unit auxiliary" switchgear.

Control of the whole of the metalclad switchgear is effected from a miniature control board with mimic diagram and pigmy lamps behind panel slots, which includes in its indications the position of each large motor starter.

The main contractors, who worked under the supervision of Mr. W. H. Taylor, chief engineer to the Western Australian Government, were the following:—

International Combustion, Ltd.	Davidson & Co., Ltd.
English Steel Corporation.	Lodge-Cottrell, Ltd.
Superheater Co.	Ivor Power Speciality Co., Ltd.
Hopkinsons, Ltd.	Wallsend Howden.
Dewrance & Co.	Gwynnes, Ltd.
Senior Economisers.	Stothert & Pitt.
Metropolitan-Vickers Electrical, Ltd.	Glenfield & Kennedy.
	Wm. Beardmore.
Lea Recorder Co.	Geo. Kent & Co.
Herbert G. Richardson & Co., Ltd.	Mather & Platt, Ltd.
Hydraulic Coupling & Engineering Co.	Vickers-Armstrong Co.
	C. A. Parsons & Co., Ltd.

FINANCIAL SECTION

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Gaskell & Grocott, Ltd.—Private company. Registered January 18th. Capital, £12,000. Objects: To acquire (1) the business of electrical porcelain manufacturers, &c., carried on at Whitehall Works, Longport, Newcastle-under-Lyme, as "Gaskell & Grocott," and (2) the business of earthenware manufacturers carried on at North Road Works, Cobridge, Stoke-on-Trent, as "Edwin Farr"; to adopt an agreement with T. Grocott and W. Grocott; and to carry on the business of manufacturers of china, earthenware, electrical insulators, &c. Subscribers: T. Grocott, 13, Bradwell Lane, and W. Grocott, 51, Dimsdale View, both of Porthill, Longport. Secretary: R. Millward.

Cotto Products, Ltd.—Private company. Registered January 18th. Capital, £40,000. Objects: To acquire the business of a machinery manufacturer carried on by R. F. Cottingham at Enterprise Works, Scunthorpe, Lincs, as Cotto Products; and to carry on the business of manufacturers of and dealers in electric washing and wringing machines, dynamos, motors, armatures, transformers, cookers, &c. Directors: R. F. Cottingham, "Hycott," Westcliffe Gardens, Scunthorpe, and J. V. Sheffield, Little Normanby, near Scunthorpe. Solicitors: H. J. Gillman & Co., Scunthorpe. Registered office: Enterprise Works, Digby Street, Scunthorpe, Lincs.

Commutator, Ltd.—Private company. Registered January 14th. Capital, £300. Objects: To carry on the business of engineering in all its branches, including that of civil, mechanical, electrical, heating, lighting, ventilating and consulting engineers, &c., and to adopt an agreement with Robert Burns, Ltd. Subscribers: J. B. Conly, 7, Carlisle Street, Dean Street, W.1, and G. B. Sambidge, 33, Riverview Park, S.E.6. Secretary: C. T. Snook, 7, Carlisle Street, W.1.

Star Components, Ltd.—Private company. Registered January 16th. Capital, £3,000. Objects: To carry on business as manufacturers, importers and exporters of and dealers in electrical, mechanical and wireless goods, metals, alloys, &c. Subscribers: M. Mott, Braeside, 103, Woodcock Hill, Kenton, Middlesex, and W. J. Murdoch, 14, Crescent Rise, N.22. Solicitors: Holmes, Son & Pott, Capel House, New Broad Street, E.C.

Associated Engineering & Electrical Supplies Co., Ltd.—Private company. Registered January 17th. Capital, £1,000. Objects: To carry on the business of dealers in electrical apparatus, machinery, tools and materials applicable used in the building, engineering and electrical engineering trades, &c. Subscribers: R. F. H. Bush, Burton Joyce, Notts, and H. S. Lowe, "Bramley," 101, Long Lane, Attenborough, Notts. Secretary: Maurice Reid-O'Connell, 9, Osborne Avenue, Sherwood, Nottingham.

Electronic Research Laboratories, Ltd.—Private company. Registered January 20th. Capital, £100. Objects: To carry on research in electronics, wireless, television, electricity and all other sciences allied thereto, &c. The subscribers are: A. J. Fossey, 160, Rushden Gardens, Ilford, and J. Roland Sedgwick, 10, Butterfields, Shernhall Street, E.17. Solicitors: Amphlett & Co., 231, Strand, W.C.2.

Southern Television and Radio Stores, Ltd.—Private company. Registered January 20th. Capital, £2,000. Objects: To carry on the business of wholesale and retail factors, manufacturers, importers and exporters of and dealers in radio, television and other sound producing or musical instruments, &c. The permanent directors are: W. J. Raybould and Mrs. M. Raybould, both of 59, The Market, Rosehill, Sutton. Secretary: C. B. Buttner, 91, Shaftesbury Avenue, W.1.

K.H. Lumino-Technical Co., Ltd.—Private company. Registered January 20th. Capital, £500. Objects: To carry on business as electrical appliance suppliers and manufacturers of and dealers in all types of electrical and mechanical apparatus and equipment, &c. The subscribers are: A. G. Calton, 154, Demesne Road, Wallington, and E. J. Crow, 24, Glenister Park Road, S.W.16. Solicitors: Theodore Goddard & Co., 10, Sergeant's Inn, E.C.4.

British Artware, Ltd.—Private company. Registered January 20th. Capital, £3,000. Objects: To carry on the business of manufacturers of and dealers in electric light fittings and accessories, electrical household articles, lights, lamps, shades, electric clocks and motors, &c. The directors are: S. Reinish, 1, Rostrevor Street, Stamford Hill, N.15, and M. Backer, 14, Hoveden Road, Cricklewood, N.W.2.

Taylor Electrical Instruments, Ltd.—Private company. Registered January 21st. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in electrical, mechanical and wireless instruments, &c. The subscribers are: G. T. Lyne, 82, Blake Avenue, Barking, and W. S. Corlett, 201a, Birkbeck Road, Beckenham. Secretary (pro tem): G. T. Lyne. Registered office: 77, Queen Victoria Street, E.C.4.

Returns of Electrical Companies

Statements of Capital

Metallic Seamless Tube Co., Ltd.—Capital, £65,333 6s. 8d. in 20,000 preference shares of 13s. 4d. and 260,000 ordinary shares of 4s. each. Return dated November 7th. 15,245 preference and 260,000 ordinary shares taken up. £36,163 6s. 8d. paid on 15,245 preference and 130,000 ordinary shares, £26,000 considered as paid on 130,000 ordinary shares. Mortgages and charges nil.

Curtis Manufacturing Co., Ltd.—Capital, £6,000 in £1 shares. Return dated September 30th (filed December 19th), 1938. All shares taken up. £1,000 paid. £5,000 considered as paid. Mortgages and charges nil.

Ferranti, Ltd.—Capital, £900,000 in £400,000 ordinary stock and shares of 10s. and £500,000 preference stock. Return dated November 11th, 1938. £300,000 ordinary and £500,000 preference stock taken up. £353,834 paid, £446,166 considered as paid. Mortgages and charges nil.

Willet & Robinson, Ltd.—Capital, £7,000 in 3,000 "A" cumulative preference, 1,000 "B" cumulative preference, and 3,000 ordinary shares of £1. Return dated November 4th, 1938. 3,000 "A" cumulative preference and 3,000 ordinary shares taken up. £6,000 paid. Mortgages and charges £8,390.

Chadwick Electrical Co., Ltd.—Capital, £500 in £1 shares. Return dated November 4th, 1938. 10 shares taken up. £10 paid. Mortgages and charges nil.

W. G. Cannon & Sons, Ltd.—Capital, £3,000 in £1 shares. Return dated September 14th, 1938. All shares taken up. £9 paid. £2,991 considered as paid. Mortgages and charges nil.

Simplex Electric Co., Ltd.—Capital, £500 in £1 shares. Return dated November 8th. All shares taken up. £500 paid. Mortgages and charges nil.

Brilliant Neon, Ltd.—Capital, £100 in £1 shares. Return dated November 9th. Two shares taken up. £2 paid. Mortgages and charges nil.

Roberne Electrical Supplies, Co., Ltd.—Capital, £1,000 in £1 shares. Return dated November 9th. 530 shares taken up. £50 paid, £478 considered as paid, £2 calls unpaid. Mortgages and charges nil.

Long & Carter, Ltd.—Capital, £1,300 in £1 shares. Return dated November 9th. All shares taken up. £800 paid, £500 considered as paid. Mortgages and charges nil.

Ignition and Electrical Services, Ltd.—Capital, £100 in £1 shares. Return dated November 11th. All shares taken up. £100 paid. Mortgages and charges nil.

Westward Electrical Co., (1928), Ltd.—Capital, £3,000 in £1 shares. Return dated June 29th, 1938 (filed January 16th, 1939). 2,235 shares taken up. £735 paid, £1,500 considered as paid. Mortgages and charges nil.

Walsall Electrical Co., Ltd.—Capital, £3,500 in 1,500 preference and 2,000 ordinary shares of £1. Return dated October 11th, 1938. 1,170 preference and 1,840 ordinary shares taken up. £3,010 paid. Mortgages and charges nil.

Derby Cables, Ltd.—Capital, £200,000 in £1 shares. Return dated November 11th, 1938. All shares taken up. £200,000 paid. Mortgages and charges nil.

Kye Electrical, Ltd.—Capital, £25,000 in 20,000 preference shares of £1 and 100,000 ordinary shares of 1s. Return dated November 11th, 1938. 12,502 preference and 92,500 ordinary shares taken up. £17,127 paid. Mortgages and charges nil.

Mortgages and Charges

Ismay Cables, Ltd.—Satisfaction in full on December 21st of (*a*) mortgage and general charge dated August 15th, 1938, and registered August 26th, 1938, and (*b*) mortgage and general charge dated November 18th, 1938, and registered November 28th, 1938. (According to the register of mortgages, the deed registered August 26th, 1938, originally secured all moneys due to bank, and the deed registered November 28th, 1938, £15,000 and all other sums to become owing.)

Croydon Engineering Co., Ltd.—Satisfaction to the extent of £5,000 (balance) on December 30th, of debentures authorised June 13th, 1929, and registered July 22nd, 1929.

Oliver Pell Control, Ltd.—Satisfaction in full on January 2nd, of debenture dated December 20th, 1937, and registered December 31st, 1937.

Battery Maintenance, Ltd.—Particulars filed of £1,000 debentures, authorised January 4th, charged on the company's undertaking and property, including uncalled capital and goodwill, the whole amount being now issued.

Folkestone Electricity Supply Co., Ltd.—Satisfaction in full on July 2nd, 1938, of debenture stock authorised by resolutions dated April 13th, 1900, August 28th, 1901, May 12th, 1905, March 14th, 1906, and March 12th, 1909, and debentures for further securing the debenture stock, and registered October 14th, 1901, June 29th, 1905, April 18th, 1906, April 30th, 1909, and May 17th, 1909. (Notice filed January 17th, 1939.)

Peto Scott Electrical Instruments (Holdings), Ltd.—Issue on January 2nd, 1939, of £4,000 debentures, part of a series already registered.

Receivers Appointed and Released

William M. Betts, Ltd.—Ernest Clark, C.A., of 52/4, High Holborn, W.C.1, was appointed receiver on January 19th, 1938, under powers contained in charge dated April 7th, 1938.

W. J. Baird, Ltd.—R. Russam, 38, Piccadilly, Bradford, was appointed receiver on January 10th, under powers contained in debenture dated August 14th, 1937.

Douglas Keith, Ltd.—A. Laban, 25/7, Oxford Street, W.1, was appointed receiver on January 9th under powers contained in debenture dated November 11th, 1938.

Southern Appliances, Ltd.—H. B. Jones, Kingsway Chambers, King Street, Maidenhead, ceased to act as receiver and manager on January 11th.

Increases of Capital

Baldwin Electro-Medical, Ltd.—The nominal capital has been increased by the addition of £900 in £1 shares, beyond the registered capital of £100.

Turner & Booth (Southport), Ltd.—The nominal capital has been increased by the addition of £2,600, beyond the registered capital of £400. The additional capital is divided into 1,000 6½ per cent. preference and 1,600 ordinary shares of £1.

Insulating Materials, Ltd.—The nominal capital has been increased by the addition of £4,000 in £1 ordinary shares, beyond the registered capital of £1,000.

Quelch & Brown, Ltd.—The nominal capital has been increased by the addition of £500 in £1 ordinary shares, beyond the registered capital of £1,500.

Reports and Dividends

R. B. Pullin & Co., Ltd.—Speaking at the annual general meeting last week Mr. R. B. Pullin, the chairman, said that he was pleased to have justified his forecast at last year's meeting that they could look forward to an even more successful year's trading in 1938. The increase of nearly 50 per cent. in the trading profits was due to a very much greater turnover, which had necessitated extensions to their factory and plant. Further extensions to be completed by the end of April would enable them to cope more comfortably with production. It had been decided to open a new factory for the manufacture of scientific optical apparatus and a site had been acquired, the plans being now in course of preparation. To cover the increased production and the costs arising out of the purchase of the land and equipment of the new factory, a resolution was approved increasing the capital from £70,000 to £100,000.

Sheffield Steel Products, Ltd.—An extraordinary meeting will be held on February 14th in Sheffield at which resolutions will be submitted for reducing the capital from £1,990,000 to £1,617,824, by cancelling £372,175 10s. of ordinary stock. Subject to the reduction taking effect it is proposed to restore the capital of the company to its present amount of £1,990,000 by the creation of 372,175 new shares of £1 each and 10 new shares of 1s. each, and to consolidate the 28,634,760 shares of 1s. in the capital so increased into 1,431,738 shares of £1 each.

Companies to be Struck Off the Register.—The names of the following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary: Day & Co. (Electrical), Ltd.; Fairbank Radio, Ltd.; Radio Lines (Shorenam-by-Sea), Ltd.; Radio Services (Birkenhead), Ltd.; Central Wireless Co., Ltd.; Dickinson Electrical Mfg. Co., Ltd.; and Hart Bros. Electrical Mfg. Co., Ltd.

Bennis Combustion, Ltd., is maintaining its interim dividend at 5 per cent.

The Traction and General Investment Trust, Ltd., reports a revenue of £99,283 for 1938, as compared with £107,546 for the preceding year. A final dividend of 8½ per cent. is to be paid, making 12½ per cent. for the year (same) and £33,855 (£32,214) is carried forward.

The Anglo-American Telegraph Co., Ltd., is to pay a final dividend of 1½ per cent. on the ordinary stock, making 3¾ per cent. (same) for the year; also a first and final dividend of 1½ per cent. (same) on the deferred ordinary stock.

British Rola, Ltd.—Lists for the offer for sale of 75,000 6½ per cent. redeemable cumulative preference £1 shares at par and 400,000 2s. ordinary shares at par were closed on January 18th, five minutes after opening.

The Electrical Industries Trust, Ltd., announces a half-yearly distribution of 2.2d., free of tax, as compared with 3.2d., tax free, for the corresponding period of 1937.

Stocks and Shares

TUESDAY EVENING.

STOCK Exchange markets are passing through a time of profound depression. The war cloud on the Continent has suddenly assumed a more threatening aspect. Preparations for defence in this country are being made at a pace which brings closer the certainty of increased national burdens, the effect of which is already seen in the depreciation that is attacking the prices of gilt-edged securities. People with money are more than ever cautious of employing it in the purchase of stocks and shares at a time when prices seem to be almost continuously downwards. Holders who are rendered nervous by the outlook, and who desire to have liquid cash, as far as possible, to hold against eventualities, have been turning out their stocks and shares upon markets far from willing to absorb them.

Business is proceeding, therefore, along difficult lines. A severe slump in most of the American stocks and shares served to accentuate the anxietv occasioned by the falls in security prices on this side. The weakness of Yankees has a distinct reflection in several of our own markets.

Reference to our price-lists will demonstrate once more the stability of electricity supply shares. Falls which have occurred in this market are comparatively light. The confidence of the investor in such issues is obviously unshaken. In days financially tempestuous, holders of shares in the British electricity supply companies must feel no little satisfaction at the steadv manner in which the quotations of their shares have withstood the general trend.

Equipment and Manufacturing

Last week's ELECTRICAL REVIEW reported on the electrical industries' feat of increasing exports in a year so bristling with difficulties in the conduct of overseas business as was 1938. It goes without saying that facts of this kind stiffen the confidence of the industry's shareholders: but with the industrial markets concerning themselves more with politics than trade, the figures go with as little influence on share prices as does the evidence of heavy expenditure on electrical equipment by the Government and the railways; or even the signs that economic recovery at home is coming into the realm of probability. Nevertheless, electrical equipment shares have escaped the worst of the week's shake-out. By comparison there is nothing very serious about falls between 1s. and 2s. in General Electrics, at 73s. 6d., English Electrics, at 32s. 6d., Associated Electricals, at 36s. 6d., and Ericssons, at 38s. 9d. The more general engineering shares have fared less well, with losses of 1/6 or more in Mather & Platt, at 45s. 9d., Murex, at 70s., Tube Investments, at 85s., and Lucas, at 53s. 9d.

Cable and Wireless

The latest Cable and Wireless traffic index covers Christmas and is, as usual, the highest figure for the year. At 77.1 the index compares well enough with November's 68, but it marks, nevertheless, the lowest December level of receipts since 1933. Over the full year the average figure is 69.3, which goes against 78.9 for the whole of 1937. Stockholders still have to look for encouragement outside the bare figures: and they find it to some extent in the lower cabling rates charged over a large part of the year. Conditions have not provided the scheme with half a chance to show its value as a stimulus to increased traffics: the lack of success up to date is considered no measure of what could happen in a more congenial atmosphere. The combine's ordinary stock has lost a point, to 37½, and the preference 2 points, to 78½. Globe Telegraph ordinary was lowered in sympathy to 25s.

American "Tel. and Tel." rose to 165 before reacting to 162½. Anglo-American stocks are ex dividend. Western Unions shed 2 points. Internationals at 9 are down ½. Gt. Northern Telegraphs at 36½ show a 10s. fall.

Dividends to Come

The approach of the dividend "season" would constitute, in normal days, a reason for expecting a little extra animation in Stock Exchange markets during the coming month or two. So far as the majority of public companies is concerned, the end of the calendar year marks the closing of the accounts. On this occasion these will reflect the results of a rather uncommon year's trade; and the many new reports due for publication between February and April will come under special scrutiny. Most of the electricity supply companies declare their final dividends in March. In view of the imperturbable upward march of electricity output and consumption, satisfactory figures in the various accounts are taken as assured even though a higher level of costs may have made its presence felt. No dividend surprises are expected. Edmundson's close their books in March, and usually declare the final dividend in June. The market expects a total of 6 per cent., which, allowing for the year's increase in capital, would equal the previous payment of 9 per cent.

Dividend Dates and Guesses

English Electric is generally one of the first in the field with its accounts, which are made up to end-December. A progressive report is expected, and a slightly higher dividend would not occasion surprise. March usually sees the final dividends from, amongst many others, Telegraph Construction, Ericssons, Hall Telephone, Lancashire Dynamo and Enfield Cable. The Enfield distribution will be on a capital larger than last year's, and a proportionate decrease in the dividend is anticipated. Associated Electrical Industries customarily make a single distribution in April, in company with British Insulated, Automatic Telephone, Reyrolle and Vickers; the last-mentioned may go a stage further in writing up the nominal value of the ordinary shares. June is hoped to bring another 20 per cent. dividend from General Electric, and distributions from Callender's, Electric Construction and Siemens.

American Factors

There is an old stock saying which declares that the American market will always let a man down. Prices of Americans will bowl along cheerfully for a time, encouraging speculators in this country to buy American shares and promoting a sentiment of optimism in the U.S.A. trade outlook. Then, without warning, prices fall heavily, often without apparent reason, and the British bull of American shares is left with them. Within the past few days something like a slump has descended upon a market which, earlier this month, seemed to be pulling itself together. The European war-cloud is the ostensible cause of the latest decline in Americans. That this explanation is wanting in logic for its defence is of no avail as an argument to oppose the fact.

Transport Matters

Although rumour has been busy with suggestions that the Buenos Aires transport scheme is at long last coming to life, the Anglo-Argentine Tramway stocks have taken a dull turn. The 4 per cent. income stock has relapsed 2 points, to 8, with bargains recorded down to 7¾. Brazilian Tractions are another weak spot at 8⅜, although Rio 5 per cent. bonds, at 55, are—paradoxically—as much as 5 points to the good. In the home traction group, Tillings and British Automobile have risen to 51s. 3d. since the report, but there is a reverse tendency in the shares of Tillings and of British Electric Traction, the controlling companies. Home Railway stocks are a poor market despite reports of better progress in the committee stages of the "square deal" appeal. Southern 5 per cent. preference has fallen 4 points to 86½. London Transport "C" stock has dropped from 74 to 72 since the announcement of the application for an upward revision of fares, and the decision of the stockholders' committee to wait upon events before considering the exercise of their rights. A loss of 3s. 9d. is shown by Bristol Tramways at 40s.

ELECTRICAL COMPANIES' SHARES

Prices, dividends and yields

Company.	1938. High-est.	1938. Low-est.	Dividend. Pre-vious.	Dividend. Last.	Price Jan. 24.	Rise or Fall.	Yield p.c. £	s.	d.
Home Electricity Companies									
Bournemouth and Poole ...	68/3	62/–	15	15	67/6	—	4	9	0
British Power & Light ...	30/9	24/6	6	7	27/–	–6d.	5	3	8
City of London	34/6	28/6	7½	7½	32/–	—	4	13	9
Clyde Valley	42/6	33/–	8	8	36/3	—	4	8	2
County of London ...	51/9	38/9	10½	10½	43/6	–6d.	4	16	5
Edmundson's :									
7% Pref....	33/3	30/–	7	7	30/–	–1/6	4	13	4
Ord.	40/9	18/9	9	9	25/–	–6d.		—	
Elec. Dis. Yorkshire ...	43/6	37/9	9	9	39/6	–6d.	4	11	2
Elec. Fin. and Securities...	51/9	49/–	12½	12½	46/3	–1/6	5	8	3
Elec. Supply Corporation...	55/–	50/–	12	12	50/–	—	4	16	0
Isle of Thanet	21/3	18/6	4	4	20/–	—	4	0	0
Lancs Light and Power ...	35/–	26/–	7½	7½	30/9	—	4	17	7
Llanelly Elec.	23/6	21/–	5½	5½	21/6	—	5	2	4
Lond. Assoc. Electric ...	32/9	28/–	7	7	29/6	—	4	13	4
London Electric	36/3	32/–	7	7	33/–	—	4	4	10
London Power Deb. Red.	108¾	100	5	5	106	—	4	14	6
Metropolitan	51/–	41/–	10	12	47/6	–9d.	5	1	1
Midland Counties	39/9	33/–	8	8	35/–	—	4	11	6
Mid. Elec. Power	41/9	37/–	8	9	40/–	—	4	10	0
Newcastle Elec.	31/9	27/6	7	7	28/9	—	4	17	4
North Eastern Electric :									
Ordinary...	34/–	25/–	7	7	30/–	—	4	13	4
7% Pref....	34/–	30/–	7	7	31/3	–9d.	4	9	6
Northampton	47/6	43/9	10	10	46/3	—	4	6	7
Notting Hill 6% Pref. (£10)	14½	13½	6	6	13½	—	4	12	4
North Met. Elec. :									
Ordinary...	49/–	43/–	10	10	43/9	–1/6	4	11	5
6% Pref....	30/6	28/3	6	6	28/6	–6d.	4	4	3
Richmond Elec.	30/6	28/–	7	7	28/9	—	4	17	5
Scottish Power	38/9	32/–	8	8	35/–	—	4	11	6
Southern Areas	22/9	18/6	4½	5	21/3	—	4	14	1
South London	32/6	31/–	7	7	31/6	—	4	9	0
West Devon	23/3	21/3	5	5	1½	—	4	9	0
West Glos.	19/–	16/9	2	2	20/–	+6d.	2	0	0
Yorkshire Elec.	42/–	36/9	8	8	37/–xd	–9d.	4	6	6
Overseas Electricity Companies									
Atlas Elec.	4/6	2/6	Nil	Nil	2/6	–3d.		—	
Calcutta Elec.	44/3	36/3	12*	10*	38/9	—	5	3	3
Cawnpore Elec.	40/–	35/–	10	10	33/–	–6d.	6	1	3
East African Power ...	28/3	22/6	7	7	24/–	—	5	16	8
Jerusalem Elec.	26/9	23/3	5	6	24/–	—	5	0	0
Kalgoorlie (10/–)	12/–	9/6	7½	7½	10/3	—	7	6	4
Madras	34/6	28/9	8*	8*	30/–	—	5	6	8
Montreal Power	31¾	26¾	1½	1½	32½	—		—	
Palestine Elec. "A" ...	31/9	27/–	7½*	7½*	28/9	–1/6	5	4	4
Perak Hydro-electric ...	25/3	17/–	7	6	18/9	—	6	8	1
Shawinigan Power ...	23½	16½	65cts.	85cts.	21¾	–1½		—	
Tokyo Elec. 6%	65½	39	6	6	53½	—	11	4	4
Victoria Falls Power ...	76/3	55/–	12	13½	65/–	–1/6	4	3	1
Whitehall Investments Pref.	22/3	15/–	7½	7½	16/3	—	9	4	8
Public Boards									
Central Electricity :									
1950–70	115¾	97	5	5	110½	—	4	10	6
1955–75	118½	100	5	5	113½	—	4	8	1
1951–73	111	95	4½	4½	106½	—	4	4	6
1963–93	101	85	3½	3½	94½	—	3	14	1
London Elec. Trans. Gtd.	93½	88	2½	2½	87½	–½	2	17	2
London & Home Counties,									
1955–75	112¾	97½	4½	4½	107	—	4	4	1
Lond. Passenger Transport :									
A	110½	104¾	4½	4½	108½	–2	4	3	0
B	122¾	105	5	5	114½	–1	4	7	4
C	84	68	4¼	4	72	–2	5	11	1
West Midlands Joint Elec.,									
1948–68	115½	102½	5	5	112	—	4	9	3
Telegraph and Telephone									
American Tel. & Tel. ...	160	114	9	9	162½	—	5	10	9
Anglo-Am. Tel. :									
Pref.	115½	100½	6	6	98½xd	–¾	6	1	10
Def.	28	23	1½	1½	23xd	+1½	6	10	8
Anglo-Portuguese	23/6	19/3	8	8	21/3	—	7	10	7
Cable & Wireless :									
5½% Pref.	104	76½	4½	5½	78½	–2	7	0	1
Ord.	67¾	34	—	4	37½	–1	10	13	4
Income	102½	99	—	—	100	—	4	0	0
Canadian Marconi $1 ...	6/6	3/9	—	Nil	4/9	—		—	
Globe Tel. & Tel. :									
Ord.	32/6	26/3	5½*	7½*	25/–	–1/6	6	0	0
Pref.	27/6	23/9	6	6	26/3	—	4	11	5
Great Northern Tel. (£10)...	42½	34	20	20	36½	–½	5	9	7
Inter. Tel. & Tel.	12½	5¾	Nil	Nil	9	–½		—	
Marconi-Marine	30/6	21/6	10	7½	23/9	—	6	6	4
Oriental Telephone Ord. ...	59/3	2½	12*	12*	2⅝	—	4	11	3
Radio Corpn.	9½	4¾	8	6	7¼	–¾		—	
Telephone Props	13/9	11/3	5	6	13/9	—	8	14	6
Telephone Rentals (5/–) ...	10/–	7/6	5	6	9/–	–3d.	3	6	8
Western Union	34½	17	2¾	—	23	–2		—	
Traction and Transport									
Anglo-Arg. Trams :									
First Pref.	11/–	2/6	Nil	Nil	5/–	—		—	
4% Inc.	31	8	Nil	Nil	8	–2		—	
British Electric Traction :									
Def. Ord.	1060	675	5	6	850	–50		—	
Pref. Ord.	175	150	8	8	160	—	5	0	0
Bristol Trams	45/–	34/3	5	8	40/–	–⅜	4	0	0
Brazil Traction	14½	7½	$1	—	8¾	–¾		—	
Calcutta Trams	26/9	21/6	8	8	24/6	—	6	10	8
Cape Elec. Trams	18/6	15/6	5	6	17/6	—	6	17	2
Lancs Transport	35/3	29/3	10	10	36/3	—	5	10	3
Mexican Light :									
1st Bonds	39	16½	5	5	25	—		—	
Rio 5% Bonds	91	47	5	5	55	+5	9	1	10
Southern Rly :									
5% Prefd.	87	48	5	—	53½	–2½		—	
5% Pref....	116	83	5	5	83½	–4	5	15	6
T. Tilling	60/–	36/6	10	10	2½	–9d.	4	14	1
Tilling & B.A.	57/–	46/–	10	9*	51/3	+⅛	3	10	2
West Riding	46/3	30/6	10	10	32/6	–1/6		—	
Equipment and Manufacturing									
Aron Electricity Ord. ...	40/3	31/–	15	15	1½	—	10	0	0
Assoc. Elec. :									
Ord.	45/3	32/–	10	10	36/6	–1/6	5	9	7
Pref.	38/9	35/6	8	8	36/–	—	4	9	0
Automatic Telephone & El.	43/–	35/–	5	10	41/3	—	4	17	1
Babcock & Wilcox ...	44/–	32/6	10	10	37/6	—	5	18	4
British Aluminium Ord. ...	54/–	40/–	10	12½	51/3	–¼	4	17	6
British Insulated Ord. ...	95/9	77/–	20	20	4½	+¼	4	17	1
British Thermostat (5/–) ...	16/–	9/–	17½	18½	13/9	–⅛	6	14	4
British Vacuum Cleaner (5/-)	35/9	27/–	40	40	22/–	—		—	
Brush Ord.	5/6	4/9	Nil	Nil	5/–	—		—	
Callender's	5⅛	78/6	20	20	77/6	—	5	3	3
Chloride Elec. Storage ...	77/9	61/–	15	20	77/6	—	5	3	3
Consolidated Signal ...	116/–	75/–	30	36½	4½	–¼	8	2	3
Crabtree (10/–)	29/–	22/–	17½	17½	23/9	—	7	7	4
Crompton Parkinson :									
Ord. (5/–)	32/3	18/9	12½	15	16/3	+6d.		—	
E. K. Cole (5/–)	8/9	4/6	5	10	5/6	—	9	1	10
Elec. & Musical Industries									
(10/–)	16/3	9/–	10	5	9/9	–6d.	5	2	7
Electric Construction ...	36/–	31/–	10	12½	32/6	—	7	13	10
Enfield Cable Ord. ...	5⅝	46/–	25	25	2⅜	—		—	
Electrical Switchgear (10/–)	27/–	22/6	16	16	26/3	—	6	2	0
English Electric	33/–	24/6	Nil	10	32/6	–1/–	6	3	1
Ensign Lamps (5/–) ...	14/3	11/3	—	25	14/–xd	—	8	18	6
Ericsson Tel. (5/–) ...	2⅜	31/–	25*	25*	38/9	–⅛	3	4	6
Ever Ready (5/–)	26/3	16/6	45	35	20/6	–6d.	8	10	8
Falk Stadelmann	34/3	27/–	10	10	27/6	—	7	5	6
Ferranti Pref.	27/6	25/–	7	7	25/–	—	5	12	0
G.E.C. :									
Pref.	34/–	31/3	6½	6½	31/3	—	4	3	2
Ord.	79/3	67/–	17½	20	73/6	–1/–	5	8	8
Greenwood & Batley ...	27/6	19/–	7	15	25/–	–⅛	12	0	0
Hall Telephone (10/–) ...	24/6	18/3	5	15	20/–	–⅛	7	10	0
Henley's (5/–)	21/–	16/–	15	20	19/6	—	5	2	7
4½% Pref.	23/–	22/–	4½	4½	22/6	—	4	0	0
Hopkinsons	40/–	32/6	10	12½	37/–	–⅛	6	15	2
India-Rubber Pref. ...	21/9	20/3	5½	5½	21/3	—	5	3	6
Intl. Combustion	5/8	4½	30	32½	5½xd	—	6	0	10
Ismay Industries (5/–) ...	6/9	1/–	6	6	1/–	—		—	
J. Lucas	57/9	47/6	15	15	53/9	–¼	5	11	6
Johnson & Phillips ...	43/9	32/6	10	12½	35/–	—	7	2	10
Lancashire Dynamo ...	72/3	53/–	20	25	65/–	—	7	14	0
Laurence Scott (5/–) ...	12/–	9/–	7	15	12/–	—	6	5	0
London Elec. Wire ...	35/–	28/3	12	7½	30/–	—	5	0	0
Mather & Platt	49/–	41/3	12	13½	46/3	–1/3	5	17	0
Metropolitan Elec. Cable Pf.	22/–	21/–	5½	5½	21/3	—	5	3	6
Murex	93/9	66/3	20	20	70/–	–⅜	5	14	5
Pye Deferred (5/–) ...	12/–	8/–	5	25	9/0	—	13	18	0
Revo (10/–)	36/3	30/–	12	17½	33/9	–⅛	5	3	7
Reyrolle	62/6	49/–	12½	12½	53/9	–⅛	4	13	0
Siemens Ord.	31/–	20/6	7½	7½	21/3	—	6	13	4
Strand Elec. (5/–) ...	6/–	4/–	5	10	5/–	—	10	0	0
S. Smith (1/–)	9/9	6/3	37½	50	7/6	–⅛	6	13	4
Switchgear & Cowan (5/–)	19/6	12/6	20	20	15/–	—	6	13	4
Telegraph Condenser (10/–)	18/9	12/–	5	5	10/–	—	5	0	0
Telegraph Construction ...	2½	36/–	7½	10	2½	—	4	14	1
Telephone Mfg. (5/–) ...	9/9	7/–	9	9	8/6	—	5	6	0
Tube Investments... ...	89/6	70/–	23¾	23¾	85/–	–⅛	5	12	0
Vactric (5/–)	9/9	4/6	10	4	3/3	—	6	3	2
Vickers (10/–)	27/–	17/6	10	10	20/3	–1/9	4	18	9
Westinghouse Brake ...	63/9	45/–	17½	17½	48/–xd	–2/6	7	6	0
Walsall Conduits (4/–) ...	26/–	22/6	—	55	25/9	—	8	11	0
West, Allen (5/–)	6/6	4/6	—	7½	6/3	–3d.	6	0	0

* Dividends are paid free of Income Tax.

NEW PATENTS

Electrical specifications recently published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1937

8269. "Superheterodyne receivers." G. Von Schaub. March 21st, 1936. (497830.)

8661 and 8662. "Electric heating apparatus suitable for cooking and other purposes." A. F. Berry. March 24th, 1937. (497924 and 497831.)

14439. "Prepayment mechanisms particularly for use in connection with electricity meters." Sangamo Weston, Ltd., and A. H. Wickham. May 24th, 1937. (497837.)

14533. "Storage batteries." Richardson Co. April 13th, 1937. (497975.)

18202. "Electric arc welding." Babcock & Wilcox, Ltd. July 1st, 1936. (497949.)

18210. "Variable electric condensers." Marconi's Wireless Telegraph Co., Ltd. June 30th, 1936. (497950.)

18213. "Multi-scale indicators more especially for multi-wave band radio receivers." Marconi's Wireless Telegraph Co., Ltd. June 30th, 1936. (497951.)

18214. "Illuminated indicating apparatus." Marconi's Wireless Telegraph Co., Ltd. June 30th, 1936. (497854.)

18233. "Method for insulating the cell body and container of electrolysers." W. J. Tennant (Druckzertestzer Ges.). June 30th, 1937. (497954.)

18234. "Arrangement for the co-operation of several electrolytic decomposing apparatus." W. J. Tennant (Druckzertestzer Ges.) June 30th, 1937. (497955.)

18235. "Bracing for electrolytic cell bodies." W. J. Tennant (Druckzertestzer Ges.) June 30th, 1937. (497956.)

The tool and machine shop at the Notting Hill, W, works of Silenthloc, Ltd., in which the Philips 100-W "Philora" sodium lamps mounted in Revo C.9981 sodium industrial fittings give a uniform illumination of 20 ft. candles on the working plane

17664. "Electric switches employing a conducting liquid." British Thomson-Houston Co., Ltd. June 24th, 1936. (497795.)

17725. "Operating means for manually-operated variable condensers and like tuning devices." Standard Telephones & Cables, Ltd., and R. E. Hall. June 25th, 1937. (497749.)

17726. "Testing equipment for telephone or like systems." Standard Telephones & Cables, Ltd., E. P. G. Wright and R. S. Holt. June 25th, 1937. (497750.)

17757. "Frequency convertors." Automatic Telephone & Electric Co., Ltd., and F. McCabe. June 25th, 1937. (497755.)

17766. "Electric welding." J. Myers and M. W. Williams. June 25th, 1937. (497845.)

17829. "Moving - contact electric-current convertors." Siemens-Schuckertwerke Akt.-Ges. June 29th, 1936. (Addition to 492269.) (497758.)

17865. "Electrical oscillators and time base-circuits." Marconi's Wireless Telegraph Co., Ltd., and R. J. Kemp. June 26th, 1937. (497760.)

17866. "Radio direction-finding receivers." Marconi's Wireless Telegraph Co., Ltd., and L. E. Q. Walker. June 26th, 1937. (497761.)

17893. "Radio and like receivers." Marconi's Wireless Telegraph Co., Ltd. June 27th, 1936. (497798.)

17894. "Electron-discharge devices." Marconi's Wireless Telegraph Co., Ltd. June 27th, 1936. (497763.)

17914. "Device for the electric welding of pipes." O. Clever. June 25th, 1937. (497764.)

17921. "Air - depolarised galvanic cells." National Carbon Co., Inc. June 27th, 1936. (Cognate application 17922/37.) (497850.)

18003. "Voltage-regulating arrangements." Automatic Telephone & Electric Co., Ltd., and M. O. Williams. June 28th, 1937. (497768.)

18266. "Electric couplings or connectors." T. Price & Son (Stampers), Ltd., and T. R. Price. July 1st, 1937. (497961)

18373. "Dielectric materials." E. L. Du Pont de Nemours & Co., A. A. Levine and O. W. Cass. July 1st, 1937. (498018.)

18400. "Means for automatically regulating the voltage and current output of variable speed dynamos." R. Bosch Ges. July 6th, 1936. (497967.)

18431. "Electric excess-consumption meters of the induction type." British Thomson-Houston Co., Ltd. July 2nd, 1936. (497858.)

18435. "Keyboard apparatus for the control of permutation members such as are used in telegraph transmitters, perforators and the like." Creed & Co., Ltd., and R. D. Salmon. July 2nd, 1937. (497970.)

18477. "Apparatus for the generation of high-voltage electric impulses." F. S. Edwards, G. J. Scoles, and Metropolitan-Vickers Electrical Co., Ltd. July 2nd, 1937. (498021.)

23336. "Cathode - ray tubes." C. Lorenz Akt.-Ges. and J. W. Rogski. August 25th, 1936. (497808.)

23476. "Thermal cut-outs for electrically heated receptacles." Burco, Ltd., and D. K. Ward. August 27th, 1937. (497809.)

23923. "Electron tube oscillator circuits." International Business Machines Corpn. September 10th, 1936. (497865.)

24068. "Electrical plug and socket connectors." J. B. Tucker. September 3rd, 1937. (497810.)

26137. "Electric - discharge lamps." General Electric Co., Ltd. (Patent-Treuhand - Ges. für Elektrische Glühlampenfabrieken.) September 27th, 1937. (Cognate application 26261/37.) (497811.)

27410. "Electric discharge lamps adapted for use as sources in optical projection apparatus." General Electric Co., Ltd., and V. J. Francis. October 8th, 1937. (Cognate application 28622/37.) (497813.)

28101. "Radio sockets." A. J. Schmidt. October 26th, 1936. (497814.)

32975. "Sparking plug having means for automatically varying the spark gap." W. F. Kilburn. November 29th, 1937. (497770.)

33993. "Electric incandescent lamp." Vereinigte Glühlampen und Elektrizitäts Akt. Ges. December 8th, 1936. (497880.)

1938

1113. "Tuning of radio receivers." E. K. Cole, Ltd., A. W. Martin and H. G. Jarvis. January 13th, 1938. (497774.)

7364. "Liquid - contact electric switches." British Thomson-Houston Co., Ltd. March 11th, 1937. (497781.)

7884. "Liquid - contact electric switches." British Thomson-Houston Co., Ltd. March 12th, 1937. (497819.)

9342. "Electric - discharge lamp systems." British Thomson-Houston Co., Ltd. March 27th, 1937. (497821.)

14040. "Electric gas or vapour discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 14th, 1937. (497822.)

15017. "Electric furnaces." James & Co. (Birmingham), Ltd., and G. Williams. May 20th, 1938. (497915.)

15447. "Air-depolarised galvanic cells and electrodes therefor." National Carbon Co., Inc. June 27th, 1936. (Divided out of 497850.) (497997.)

15448. "Air-depolarised galvanic cells and electrodes therefor." National Carbon Co., Inc. June 27th, 1936. (Divided out of 497850.) (497916.)

15926. "Trolley current-collectors for electric vehicles." Pollopas Patents, Ltd., and L. E. W. Montrose-Oster. May 27th, 1937. (497998.)

20066. "Apparatus for the electrical precipitation of suspended particles from gaseous fluids." Lodge-Cottrell, Ltd. (Siemens - Lurgi - Cottrell - Elektrofilter-Ges. für Forschang und Patentvertung). July 6th, 1938. (497825.)

31259. "Electromagnetically operated electric switches." A. Cianchi. April 28th, 1937. (Divided out of 494728.) (Addition to 482867.) (497828.)

32147. "Prepayment mechanisms particularly for use in connection with electricity meters." Sangamo Weston, Ltd., and A. H. Wickham. May 24th, 1937. (Divided out of 497837.) (497923.)

TRADE MARK APPLICATIONS

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 18th :—

Erco. No. 585797. Class 6 (III). Electric vacuum cleaning machines.—Edward B. Beverton, trading as E.R. Co., 21, Park Road, Bromley, Kent.

Dispolene. No. 602837. Class 2 (IV). Synthetic resin.—Honeywill & Stern, 21, St. James' Square, S.W.1.

Kuostat. No. 601550. Also Westat. No. 601552. Class 9 (IV). Self-regulating electric power supply units comprising transformers and rectifiers for supplying DC loads from AC supply circuits.—Westinghouse Brake and Signal Co., Ltd., 82, York Way, King's Cross, N.1.

Drimet. No. 602199. Class 9 (IV). Electric current rectifiers.—Partridge, Wilson & Co., Ltd., Davenset Works, Evington Valley Road, Leicester.

Sigor. No. 601328. Class 11 (IV). Incandescent electric lamps.—Société des Lampes et Entreprises Electriques Ninove, Belgium. (British representatives: Cope & Co., 65, Victoria Street, Westminster, S.W.1.)

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Australia. — MELBOURNE. — February 20th. City Council. Forty-eight ring main isolating switches. (T. 3066/38.)*
Posts and Telegraphs Department. February 21st. Insulating materials. (T. 30879/1938.)*
March 20th. Underground cable. (T. 17692/39.)*
Postmaster-General's Department. February 28th. Protectors, mountings, fuses, heat coils, mica, carbons and fuse wire. (T. 30926/1938.)*
February 21st. Cable. (T.30832/38.)*
March 7th. Insulated wire. (T. 30928/1938.)*
March 21st. Seven engine generator sets and associated equipment. (T. 17061/39.)*
BRISBANE.—March 17th. City Council. Nine 11,000-V metal-clad switch equipments, control board equipment, eight 660-V metal-clad switch equipments and power and control cables. (T. 17216/39.)*

Ayr.—January 30th. County Council. Electric lighting at Ballantrae Public School and at new elementary school at Troon. County architect, County Buildings.

Ayrshire.—January 30th. Joint Committee for Management of Institutions. Electric lighting of new lodges at Kyle Home, Ayr. County architect, County Buildings, Ayr.

Beverley.—January 31st. R.D.C. Electrical installations in ten houses at Bishop Burton. Clerk to the Council, 26-28, Lairgate (deposit £1 1s.).

Bexhill.—February 6th. Electricity Department. 200/750-kVA transformers for 11-kV system and a low-voltage, air-break switchboard. (See this issue.)

Blackpool.—February 9th. Electricity Department. Electricity meters for twelve months. (See this issue.)

Brighton. —January 30th. Corporation. Electric lighting, heating and power installations in 266 houses now in course of erection on the East Moulsecomb estate. Specifications and drawings from borough engineer and surveyor.

Bromley.—February 10th. Electricity Department. Extra-high- and low-voltage cable. (See this issue.)

Cardiff.—February 6th. Electricity Department. Meters, cables, conductors and lamps for twelve months. (January 20th.)
February 13th. E.h.v. sub-station switchgear, house-service meters and extra-high and low-voltage, p.i. cables for twelve months. (January 20th.)

Cheadle and Gatley.—February 13th. Electricity Department. Stores and materials for twelve months. (See this issue.)

Colchester.—February 13th. Essex and Colchester Mental Hospital Committee. 200-kW high-speed generating set for Severalls Mental Hospital. County architect, County Hall, Chelmsford (deposit £2 2s.).

Dover.—January 30th. Corporation. Extra-high- and low-voltage cables and oil-cooled transformers for twelve months; mercury-discharge street lighting equipment. (January 13th.)

Dundee.—February 15th. Electricity Department. Low-voltage, p.i., lead-covered cable. (See this issue.)

Dunfermline.—January 30th. Corporation. Electric lighting work at police station and clinic at Townhill. Town Clerk.

Eccles.—January 30th. Borough Council. One 11-panel, extra-high-voltage, metal-clad switchboard. Borough electrical engineer, Electricity Offices, 1, King Street.

Egypt.—ALEXANDRIA.—February 25th. Ports and Lighthouses Administration. Two electrically driven centrifugal pumps. (T. 17696/39.)*

Epsom and Ewell.—February 20th. Electricity Department. One 300-kVA transformer and extra-high-voltage switchgear. (See this issue.)

Erith.—February 13th. Electricity Department. Stores and materials for twelve months. (January 20th.)

Falkirk.—Town Council. Electrical work at seventy-four houses on the Cobblebrae site. Schedules from burgh engineer, Arnotdale.

Falkland.—February 6th. Town Council. Electrical work at twenty-four houses. Town Clerk, Bank Buildings.

Gainsborough.—February 17th. Electricity Department. Two 3-phase oil-cooled transformers, low-voltage, p.i. cables, meter boards and joint box compound. (January 20th.)

Gellygaer. — February 17th. U.D.C. Stores and materials for twelve months. (January 20th.)

Gloucester.—February 3rd. Electricity Department. Electric cookers, water-heaters and washboilers for nine months. (January 20th.)

Great Yarmouth.—February 14th. Electricity Supply Department. Cables, meters, transformers, lamps, cookers, water-heaters, kiosks and switchgear for twelve months. (January 20th.)

Halifax.—February 17th. Electricity Department. Turbine house steelwork and electric travelling crane. (See this issue.)

Heston and Isleworth.—February 15th. Electricity Department. Stores and materials for twelve months. (See this issue.)

Horsforth.—February 4th. U.D.C. Low-voltage electric power cables at the new borehole and high level pumping stations in Scotland Lane. Clerk of the Council, Council Offices.

Huddersfield.—February 11th. Education Committee. Electric lighting fittings at extensions to the technical college, Queen Street South. Town Clerk, Town Hall (deposit £2 2s.).

India.—CALCUTTA.—February 14th. Indian Stores Department. Switchboard panels, power house crane and motor-driven air compressor for the railway power house at Mari Indus. (T.Y. 17647/39.)*
NEW DELHI.—February 7th. Indian Stores Department. Porcelain insulators for twelve months. (T. 17650/39.)*

Kingston-upon-Thames.—January 28th. Electricity Department. Stores and materials for twelve months. (January 13th.)

Leeds.—February 15th. Electricity Department. Stores and materials for twelve months. (See this issue.)
February 10th. Transport Department. General stores, including electric lamps for twelve months. Town Clerk, Civic Hall (deposit £1 1s.).

Letterkenny (EIRE). — February 11th. Committee of Management of Donegal Mental Hospital. Installation of electric lighting, conduit fittings, switchgear, low-pressure hot-water installation, kitchen and laundry equipment and incidental works. Plans and specifications from P. J. Courtney, R.M.S. Mental Hospital.

Leyton.—February 13th. Electricity Department. Two 500-kVA transformers. (See this issue.)

London.—H.M. OFFICE OF WORKS.—February 3rd. High- and low-voltage cables and accessories at Glascoed R.O.F. (January 13th.)
February 3rd. Transformers for Glascoed and Pembrey R.O.F. (January 13th.)
February 14th. Low-voltage, ironclad switchgear distribution boards for Pembrey R.O.F. (See this issue.)
February 17th. Lightning protection system for Pembrey R.O.F. (See this issue.)
February 21st. Low-voltage cable and accessories at Blackburn R.O.F. (See this issue.)
BATTERSEA.—February 8th. Borough Council. Stores and materials for twelve months. (January 13th.)

Louth.—February 13th. Electricity Department. Steel lamp standards. (See this issue.)

Middlesex.—February 22nd. County Council. Electrical sundries for twelve months and X-ray and lighting requisites for six months. (See this issue.)

Middleton.—February 11th. Electricity Department. Extra-high- and low-voltage cables. (See this issue.)

Newton-in-Makerfield.—February 6th. Electricity Department. P.i. cables for twelve months. (January 13th.)

New Zealand.—WELLINGTON.—February 28th. Public Works Department. One 11-kV oil-circuit-breaker for the R.N.Z.A.F. station, Ohakea. T. 17306/39.)*
February 28th. Four 333-kVA transformers. (T. 30910/1938.)*
March 21st. One complete set of 50-kV, 33-kV and 11-kV outdoor switchgear and steelwork. (T. 17212/39.)*
May 2nd. Six 8,000-kVA, 11,000/63,500-V transformer units. (T. 17197/39.)*
Two vertical shaft 25,000-kVA AC generators and turbines. (T. 17198/39.)*
May 9th. Turbine, generator and control equipment. (T. 17210/39.)*
February 14th. Internal combustion engines and generating sets. (T.Y. 17299/39.)*
February 25th. Distribution switchboard for the R.N.Z.A.F. station, Ohakea. (T.Y. 17305/39.)*
May 9th. Four 9,333-kVA transformers, complete with accessories. (T. 17208/39.)*

Northumberland. — County Council. Electrical installation at Wooley Sanatorium. County architect, County Hall, Newcastle-on-Tyne.

Plymouth.—February 4th. Electricity Department. Cables, meters, time switches, joint boxes and stevedore's work. (January 20th.)

Rothesay.—February 2nd. Electricity Department. Diesel engines for a 500-kW set, complete with switchgear and accessories. (January 13th.)

Salford. — February 15th. Electricity Department. Electrical stores and materials. (See this issue.)

Sheffield.—February 10th. Electricity Department. Standard distribution transformers for twelve months. (January 20th.)

South Africa.—JOHANNESBURG. — City Council. February 18th. 60 miles of copper conductor. (T. 17160/39.)*
CAPE TOWN.—February 1st. Electricity Supply Commission. Two 500-kVA three-phase transformers, high- and low-voltage and pilot cable and one complete 380-V switchboard. (T. 30893/38.)*
March 1st. Electricity Department. Outdoor type transformers. (T.Y. 30892/38.)*
February 15th. Quantities of ironclad service cut-outs. (T. 17335/39.)*
PIETERSBURG.—February 1st. Municipality. Turbo-alternator, boiler, steam piping and crane, switchgear, transformers, cable, cable boxes, isolating links and insulators. (T. 17270/39.)*
PRETORIA.—February 9th. Union Tender and Supplies Board. 4,250-ft. of 0.0225 sq. in. underground cable. (T. 17484/39.)*

St. Helens.—February 10th. Electricity Department. Fire-extinguishing equipment. (See this issue.)

Stoke-on-Trent.—February 8th. Electrical Engineer's Department. AC meters for twelve months. (January 20th.)

Swansea. — January 31st. Electricity Department. Stores and materials for twelve months. (January 13th.)

Torquay.—February 3rd. Corporation. Electric lamps for twelve months. Town Clerk.

Tredegar.—February 13th. Electricity Department. Stores and materials for twelve months. (See this issue.)

Walthamstow.—February 3rd. Corporation. Electrical installation at new branch library at Wood Street. (January 13th.)

Wolverhampton.—February 20th. Borough Council. Electrical engineering stores for twelve months. (January 20th.)

Worthing.—February 8th. Electricity Department. Extra-high and low-voltage cables. (See this issue.)

Orders Placed

Barnstaple.—Town Council. Accepted. Electrical installation at the new senior boys' school (£694).—Ray Furse (Barnstaple).

Birmingham. — Accepted. Electrical installation at Cavendish House, Waterloo Street.—F. Burton.

Exeter.—Electricity Committee. Accepted. Three transformers (£306).—Bonar, Long & Co. Three switchboards (£2,100).—J. G. Statter & Co.

Glasgow.—Transport Committee. Accepted. Electrical equipment in connection with two new experimental truck cars.—G.E.C. (£704) and Crompton Parkinson (£704).

Housing Committee. Accepted. Electrical installations at 480 houses at Barrowfield (£3,191).—A. C. Moore.

Hertfordshire. — Health Committee. Accepted. Electrical installation at Watford Children's Homes (£200).—J. W. Russell. X-ray plant for Barnet Hospital (£426).—Watson & Sons (Electro-Medical).

London. — METROPOLITAN WATER BOARD.—Recommended. Electric pump and switchgear for Cricklewood pumping station (£710).—W. H. Allen, Sons & Co.

L.C.C.—Wiring and fittings for electric lighting, &c., in blocks of dwellings on the Pembury estate, Hackney.—Pemberton & Sturgess (Great Britain), Ltd. (£3,447). Wiring and fittings for electric lighting, &c., in a block of dwellings on the Crossfield estate (Frankham Street area), Deptford.—Pemberton & Sturgess (£575).

ST. PANCRAS.—Contracts and Stores Committee. Recommended. High-voltage switchgear at the Regent's Park and Grafton Road sub-stations (£3,620).—B.T.H. Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Acton.—Factory, Atlas Road; T. Wall & Sons, Ltd.

Ashington.—Reconstruction of the Miners' Hall Cinema, for the Wallaw Cinemas; G. Towers, builder, Union Street, Blyth.

Ashton-under-Lyne. — Houses (96), Hurst Hall estate; borough engineer.

Bamber Bridge.—R.C. senior school (£28,316), for St. Mary's Church Authorities; R. Mercer, architect, 11, Chapel Street, Preston.

Barnet.—Houses (1,200), Folly Farm estate, Hadley Wood; New Ideal Homesteads, Ltd., Carlton Road, Erith.

Birmingham.—Factory and warehouse, Castle Street, for Hammond & Co., Scotland Passage, Birmingham; W. C. Skinner, Ltd., builders, Birchfield Road, Birmingham.

Boreham Wood.—Six factories, Manor Way; J. Laing & Son, Ltd., Mill Hill, London, N.W.7.

Bridgwater. — Extensions to Council offices (£5,860); borough engineer.

Brighton.—Houses (67), Carlton estate; borough engineer.

Burton Latimer.—Estate development, Higham Hill; Captain J. L. Harpur.

Cardiff.—Houses (50), North Road; Western Ground Rents, Ltd.

Caterham. — Additions to Council Offices (£2,373); U.D.C. surveyor.

Chertsey. — Houses (30), Wheatash Road; A. E. Wells.

Chester.—Houses (102), Blacon estate; A. Bormstein. Cinema, Christleton Street; A. H. Moorcroft.

Consett.—Houses (72), Pont Head estate; U.D.C. surveyor.

Coseley.—Houses (108), Chad Row estate; U.D.C. surveyor.

Coventry.—Houses (36), Frankpledge Road and Court Leet Road; Merrett & Co., 12, Bede Road. Houses (53), Kempley Avenue, Momus Boulevard, Briars Close, Bromleigh Drive; A. E. White, Anstey Road, Wyken. Houses (40), Nunts Lane, Nunts Park Avenue and Meadow Road; T. Dalton & Co., Wyken, Wargrave-on-Sowe. Houses (24), Owenford Road; A. W. Jervis, Holyhead Road. Houses (32), Tonbridge Road and London Road; F. A. Sutton, 66, Albany Road.

Cricklewood. — Factory, Cricklewood Lane; Towndrow & Ransom, architects, 14, Bloomsbury Way, London, W.C.1.

Croydon.—Enlargement of Archbishop Tenison's School, Selsdon Road; H. Williams & Partners. Extensions to nurses' home, Mayday Hospital (£16,000); borough engineer.

Daventry.—Extensions to Institution (£9,345); Bosworth & Wakeford.

Dovercourt.—Cinema and café, for J. Elliott; F. E. Bromige, architect, Kingley Street, Regent Street, London, W.1.

Dumbarton.—Houses (50); M'Taggart & Mickel, Ltd., Glasgow.

Easington.—Houses (168), Wheatley Hill, for the R.D.C.; C. W. Clarke, surveyor.

Enfield.—Sports centre, Bury Farm estate (£14,059); borough engineer.

Erith.—Maternity home and clinic (£25,000); U.D.C. surveyor.

Esher.—Houses (118); F. Edwards, clerk, Council Offices, Esher, Surrey.

Essex. — Laboratory, Chelmsford (£9,925); county architect.

Exeter.—Enlargement of Institution (£67,970); city engineer.

Fourstones (NORTHUMBERLAND). — Houses (20); W. Dixon and Son, architects, 1, Collingwood Street, Newcastle-on-Tyne.

Gateshead. — Extensions to factory, Fibreboard Boxes, Ltd., Team Valley estate; Cackett, Burns, Dick & McKellar, architects, 21, Ellison Place, Newcastle-on-Tyne.

Glasgow.—Houses (480). Barrowfield, and (2,862), Rosehill, Saterland and Priesthill; housing director. Bank premises for National Bank of Scotland, Ltd., at the corner of Dalmarnock Road and Bartholomew Street, and additions and alterations to infirmary; Watson, Salmond and Gray, architects, 111, Union Street.

Goole.—Potato meal factory, for the Farmers' Market & Supply Co., Ltd.

Heston and Isleworth.—Houses (63), Penbury Road and Court Road, Norwood Green estate; Bostock & Hollins, South Road, Southall.

Hove.—Houses (16), Northease Drive and Summerdale Road, for T.C.

Jarrow-on-Tyne. — General hospital; borough engineer.

Kent.—School, Southfleet Lane, Swanscombe (£50,840); county architect, Maidstone.

Lancaster.—Maternity block at the Royal Lancaster Infirmary (£60,000), for the Lancashire County Council; Edgar Middleton, architect, 38, Barton Road, Lancaster.

Leamington Spa.—Police buildings and fire station (£50,000) with electrical work; B. Whitehouse & Sons, builders, Monument Road, Edgbaston.

Leeds.—Extensions to premises, for the Leeds Permanent Building Society, The Headrow (£100,000); C. Castlelow, architect, Park Row.

Lichfield. — Houses (60), Ponesfields estate; borough engineer.

Liverpool. — Houses (20), Birchfield Road, Edge Grove; Banber Estates, Ltd. Houses (54), Muirhead Avenue East, Meadow Lane and Meadow Way; Scarratt Bros., 69, Town Road, Old Swan, Liverpool.

London. — (HAMPSTEAD). — Reconstruction of Town Hall, Finchley Road (£53,000); Slater, Moberley & Uren, architects, 46, Berners Street, London, W.1.

Monmouthshire. — School, Nantyglo (£24,640), for the County E.C.

Newcastle-on-Tyne.—Underground car parks and air-raid shelters (£250,000); city engineer. School, Fawdon, for E.C.; education architect, Northumberland Road.

Northamptonshire. — A.R.P. depots, Kettering, Wellingborough, Oundle, Desborough, Brixworth, Rushden, Daventry, Towcester, &c. (£25,000), for the County Council.

Northumberland.—Staff cottages and canteen, St. Andrew's Colony, and school, Amble, for the C.C.; W. W. Tasker, architect, County Hall, Newcastle-on-Tyne.

Norwich. — Technical college and school of art (£172,000); Gee, Walker & Slater, Ltd., contractors, Uttoxeter Old Road, Derby.

Nuneaton.—Houses (36), near Higham Lane; J. Hextall, builder, St. Ronan's.

Oldham. — Houses (166), Strinesdale estate; borough engineer.

Peterborough. — School, Pudholme Road; Dodson & Son, architects, Museum Buildings, Priestgate, Peterborough.

Prestwick.—Houses (160), Marchburn Avenue; F. Pritty, burgh surveyor.

Richmond-on-Thames.—Air-raid shelter and underground car park, under Richmond Green (£47,000); borough surveyor.

Ripon.—Houses, Gallows Hill estate; borough engineer.

Rowley Regis.—Rebuilding factory premises, Elbow Street, Old Hill; T. B. Wellings, Ltd.

Salisbury.—School, Devizes Road, for E.C.; Bothams & Brown, architects, 32, Chipper Lane.

Sheffield.—Cinemas, for Forum Cinema (Sheffield), Ltd.; M. J. Gleeson, Cloonmore, Woodseats.

Shotton (NEAR CHESTER).—Hot and cold rolling strip mill, for John Summers & Sons, Ltd.

Southfields.—Large extensions to dyeworks, Kimber Road, for Metropolitan Dyers & Cleaners, Ltd.; Woodroffe & Son, architects, 5, Bedford Row, London, W.C.1.

Stafford.—Houses (125), Silkmore estate, for T.C.; Sabin & Young, Ltd., builders, Rushall, Walsall.

Stirling. — Houses (152), Linden Avenue, Raploch Road and Bannockburn Road; burgh surveyor.

Stockton-on-Tees. — Bakery and canteen, for Sparks and Son; W. A. King & Son, builders, Westbourne Grove, North Ormesby, Middlesbrough. Premises, for Messrs. Marsh; H. C. Garbutt, architect, 18, Albert Road, Middlesbrough.

Sutton.—Houses (42), Fulcourt Close; F. N. Woolgar, builders, Wickham Road, Shirley, Croydon.

Sunderland.—Community centre, Ford estate (£12,000); borough engineer.

Tynemouth.—Extensions to Victoria Jubilee Infirmary; Cackett, Burns, Dick & McKellar, architects, 21, Ellison Place, Newcastle-on-Tyne.

Urmston.—Houses (105), Southgate; J. Barker, builder, Deganwy, Hayeswater Road.

Waddon.—Factory and offices, Hospital Road; W. Howard Price, Ltd.

Wallsend-on-Tyne. — Development of estate, Holy Cross; Alder Gofton & Sons. Hotel, Tynemouth Road, for Blayney & Co., Ltd.; Marshall, Tweedy & Bourn, architects, 36, Blackett Street, Newcastle-on-Tyne.

Warwickshire.—Police station, Coleshill (£22,195); county architect.

West Hartlepool. — Houses (1,465), under five years' plan, and school, Stockton Road; borough engineer.

Willington-on-Tyne.—Cinema, for J. McHarg, Wallsend-on-Tyne; Stephen Easten, Ltd., contractors, Milburn House, Newcastle-on-Tyne.

Yorkshire. — School and caretaker's house, Swinton, for the West Riding E.C.; Gribbon, Foggitt & Brown, architects, 3, Park Place, Leeds.